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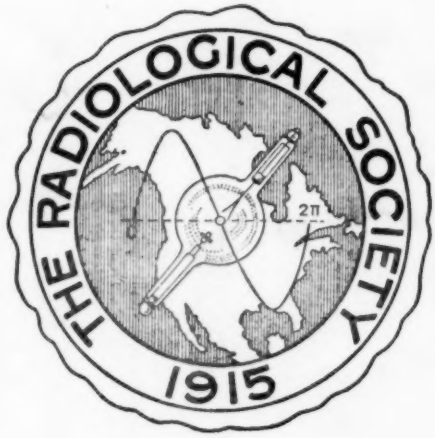

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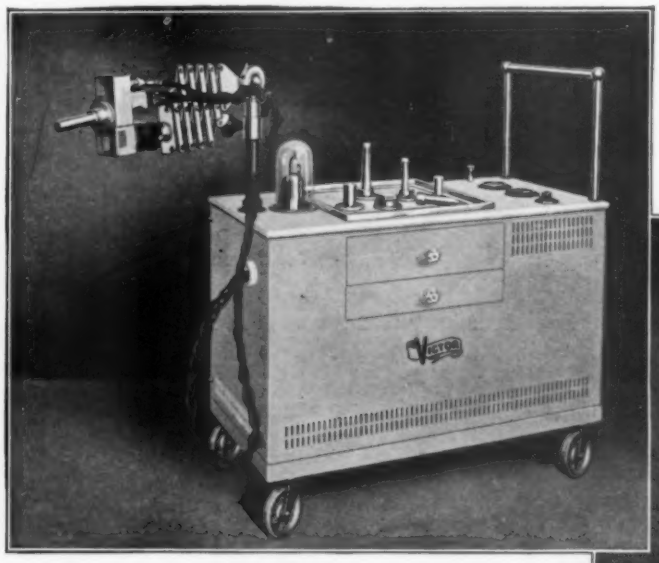

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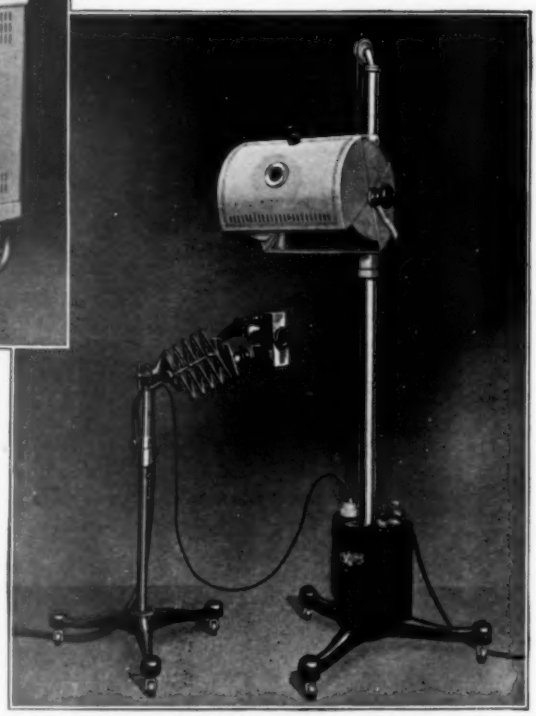

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A Study of Legg's Disease, with Report of Cases*

ROY G. GILES, A. B., M. D.
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UNTIL the presentation of Arthur T. Legg's [1] article "An Obscure Affection of the Hip-joint," before the American Orthopedic Association in 1909, such cases were usually diagnosed and treated as tuberculous coxitis. This mistake is still often made, and much has been written under various headings, but little has been added to Legg's original article. To him belongs the credit for the discovery of the disease known as osteochondral trophopathy of the hip-joint, osteochondritis deformans juvenilis, Perthes' disease, a particular form of coxalgia, Calve's disease, quiet hip disease, etc.

In July, 1910, Jaques Calve [2] presented ten cases of a similar nature under the caption. " A Particular Form of Coxalgia." These cases were selected from five hundred of his original cases previously diagnosed coxalgia. The same year Perthes [3] of Tubingen presented cases of this disease as "Arthritis Deformans Juvenilis." Although this paper was not published until after that of Legg, this condition is generally known as "Perthes' Disease." Taylor [4] has described this affection as "Quiet Hip Disease."

Many theories have been offered pertaining to the etiology of osteochondral trophopathy of the hip-joint. Heredity, obscure infection, faulty metabolism, syphilis, and traumatism have each been suggested. Calve [2] Schwartz [5] and Eden [6] have noted the hereditary character of this affection.

Frederick C. Kidner [7] of Detroit, in a paper published in 1916, suggests "that it is really a mild infection of hematogenous origin of the neck of the femur at the epiphyseal region." Legg likewise in his original paper cites one case in which an operation was performed and a septic focus curetted from the neck of the femur. He believed this focus to be only a coincidence and in no way responsible for the changes in the head and neck of the femur.

Delitala [8] believes we must look for the origin of the disease in, "a congenital alteration either of the epiphyseal cartilage of the upper end of the femur or of the epiphyseal nucleus, which gives away to processes of ossification which are insufficient and irregular."

Calve [2] suggests that rachictic conditions cause disturbance of metabolism by deforming the bony structures in the hip, and are likely the first source of the disease.

Perthes [3] removed from one of his cases at operation a small section of bone, cartilage and synovial membrane from the head of the femur. This specimen showed an overgrowth of abnormal cartilage which extended down into fairly normal bone. This experiment has been of little value, since the specimen was removed from a region which the x-rays showed to be little affected.

In 1917, P. W. Roberts [9] of New York, published an article in which he says, "traumatism, obscure infection, and perverted metabolism have each had their advocates. Tuberculosis has been eliminated because the joint recovers with good function, and syphilis has been eliminated because the Wassermann reactions are negative." In spite of the laboratory tests he cites two cases in which the x-ray findings seemed typical of osteochondritis and which had been treated for tuberculosis over a period of many months without improvement. These cases showed, in their teeth, evidence of inherited syphilis and very promptly responded to mixed treatment. In 1919, he reported ten other cases which he considered to be congenital syphilis and which had been diagnosed osteochondral trophopathy of the hip-joint. Not only was there rapid subsidence of acute symptoms under mixed treatment, but of eight bloods tested with cholestrinized antigens all were positive. Most every disease of the bone diagnosed by means of the x-ray has at some time during its etiological discussion, had syphilis offered as a causative factor.

Allison [10] opened the hip-joint of rabbits, producing a moderate trauma, but was unable to bring about a condition simulating osteochondral trophopathy in children.

Most writers agree that sixty-five to seventy per cent of these cases give a definite history of trauma. Zaaiger [11] calls attention to fifty-five cases reported in the literature in 1914, sixty-six per cent of which gave a definite history of injury. Legg [1] offered no opinion in his original article as to the cause of this disease, but noted that the occurrence of a traumatism was definitely related in time to the appearance of the limp. In 1916, he presented fifty-five cases, sixty-eight per cent of which gave a definite history of trauma. He divided these cases as follows: (1) cases of known trauma, (2) cases of operative trauma, (3) cases in which there was no history of trauma.

In cases of known trauma thirty-eight per cent of the fifty-five cases gave a history of injury, and fifty per cent of these came in for treatment from six months to four years after the limp was noted. Boys were more frequently affected than girls in the proportion of nine to one.

Of the fifty-five cases, thirty per cent gave a history of operative trauma, following the reduction of congenital dislocation of the hip. According to Legg, this condition occurs more frequently in girls than in boys, and there was only one boy affected in this group of seventeen cases.

Likewise, thirty per cent of the cases gave no history of trauma, but the affection, the end result, the x-ray, and the clinical findings were the same for both groups. For this reason he thinks that, due to personal variations, both as to memory and accuracy, the patient or the parent failed to report the injury in relation to the onset of the symptoms.

On account of the frequent history of trauma, Legg [1] has concluded that the atrophy in the epiphysis, the loss of substance in the sub-epiphyseal region, and the hypertrophic thickening of the neck of the femur, are due to

*—Read at the Annual Meeting of The Radiological Society of North America, Chicago, Dec. 7, 1921.

Figure I.—Case I.

derangement of nutrition brought about by interference in the blood supply following traumatism at the epiphyseal line.

Legg [1] says: "The traumatic conception of etiology is excellently supported by the history of the disease itself. If one reviews the facts of occurrence and course, it is found that a spontaneous affection in a joint arises without, so far as can be determined, any systemic or infectious disease-producing cause. An initial mild acuteness, as far as symptomatology is concerned, passes through a gradual self-reparative process and gives generally an end result, frequently without any assisting treatment, of a slight persistent limp and motion limitation, or a perfect recovery. Such a combination of onset, cause, and end result, is typically traumatic and the strictly accessory nature of the treatment is quite similar to that which is possible in cases of more serious traumatism. * * * The proportionate occurrence in boys is very marked in all reports, and lends supporting circumstantial evidence to the idea of traumatic origin."

Most writers agree that this affection occurs between the ages of five and ten, with an extreme range of two and one-half to twelve, as given by Legg. Osteochondral trophopathy of the hip-joint usually occurs unilaterally, but most writers report cases of bilateral involvement.

There is usually a very insidious onset, and the only symptom in evidence is a limp, which is most often associated with trauma. It appears from six to thirty-six months after the injury. Unlike tuberculosis, at first there is no spasm and mobility is only slightly impaired, but later there is limitation of motion, most marked in abduction and external rotation, and flexion is unaffected. There may be some spasm in attempting forced motion. Pain is entirely absent or slight, though exaggerated movements of the hip-joint cause pain of slight degree. Night cries usually do not occur in this affection. The majority of the cases show evidence of slight atrophy of the epiphysis and of the neck of the femur. We often get shortening of one-quarter to one-half an inch, and the trochanter is most frequently elevated and may be prominent.

The children usually give a previous record of good health and are often very active. There is little or no pain, no previous condition of disease, and no sign of active infection. The activity, development and growth of the child are usually not affected. As a rule the patient's history is negative, but the ordinary diseases of childhood occur in various individuals. There may be no family history of tuberculosis or syphilis, and the Von Pirquet and Wassermann tests may be negative.

Figure II.—Case II.

Figure III.—Case III.—Same case as shown in Figure II., nine months later.

Figure IV.—Case II.—Same case as shown in Figure 3, three months later.

The progress of the disease is from six to twelve months, with an abatement of symptoms after one to two years. Recovery occurs with a remodeled joint, but with excellent function. After the symptoms have disappeared there remains only a slight restriction of motion, and the characteristic x-ray findings to identify the process. Ankylosis, restricted flexion, and limited abduction, seen so commonly after recovery from tuberculosis, usually do not occur in osteochondral trophopathy of the hip-joint.

The roentgen appearance is characteristic of this disease. Holmes and Ruggles [12] describe the x-ray findings as, "a flattening and mushrooming of the head of the femur, suggesting tuberculosis, but without typical clinical signs. The joint is not involved. There is little bone atrophy and interference with growth is not marked." They describe tuberculosis as follows. "It causes a slight enlargement of the soft parts, effusion in the capsule and general haziness and muddiness of the entire joint area. There is extreme decalcification, so that the outline of the bones may be reduced to thin penciled white lines. Enlargement and squaring of the epiphysis are seen, and later more or less destruction of joint surfaces, and interference with the growth of bone. There is no new bone formation. The occurrence of periosteal reaction and bony ankylosis in these joints is the result of secondary infection. During the process of repair there is increase in density due to the deposit of lime salts."

All writers agree that very little treatment is necessary, since the disease is self limited and tends to spontaneous cure. Blanchard [13] of Chicago says, "early and continued mechanical treatment that protects the head of the femur from weight bearing, jar and concussion, will usually preserve the head in its rounded shape, but observation of a number of treated and untreated cases shows that the best available mechanical treatment has little or no effect in preventing or causing atrophy of the bone and muscles of the leg of the diseased side." Legg [1] states, "the healing process tends to come about naturally, and by watching the patient and affording any accessory, which dimin-

Figure V.—Case III.

Figure VI.—Case III.—Same case as shown in Figure V., seven years later.

ishes strain upon the hip to facilitate recovery by means of repair, is all that can be done."

Case I.—J. B., male, age six, complained of pain in the left hip, and his parents noticed a slight limp about one year before the roentgenograms were made. He did not give a definite history of injury, but had always been strong and active. There was no family history of tuberculosis or syphilis and the Von Pirquet and Wassermann reactions were negative. He had no constitutional symptoms. Flexion, abduction and extension were only slightly limited. In July, 1920, the boy was a perfect picture of health and his limp was scarcely noticeable. His father would not give his consent to a second radiographic examination. Fig. 1 (July, 1914): Roentgenogram shows the head flattened, epiphysis thin, joint surface not affected. The right hip is normal.

Case II.—R. S., male, age nine, complained of pain in the left hip and began to limp soon after a fall from the barn loft in May, 1918. He gave no family history of tuberculosis or syphilis and did not have fever or night sweats. One year after the fall from the loft (May, 1919) the limp was much more noticeable. A physical examination at this time showed one-half inch shortening, atrophy of the calf and thigh, lack of symmetry of the gluteal fold, and a slight limitation of flexion, abduction and hyperextension. Fig. 2. (May, 1919): Radiogram shows flattening of the head and thickening of the neck of the femur. The joint space is smooth in outline and is not involved. Fig. 3, (February, 1920): There is increased flattening of the head and spreading of the epiphysis and beginning changes in the neck of the femur. Fig. 4. (May, 1920): Shows progressive flattening of the head and moderate thickening of the neck of the femur on the left and on the right. The joint spaces are smooth in outline and are not involved. The epiphysis on the left is flattened to such an extent that it has become very small and thin, and the surface is somewhat irregular in outline. The flattening and mushrooming of the head and the increased thickness of the neck of the femur of the right hip, shows about the same degree of change or deformity as the left hip did one year ago, when the right hip was normal.

Case III.—H. S., male, age thirteen, began to limp about eighteen months before the roentgenogram was made, and during this period he was treated for rheumatism. He had always been very strong and active. He fell from an ice wagon about four years before the limp was noticed. He complained of slight pain during the night, but had no pain during the day while up and playing. He did not have a family history of tuberculosis, or syphilis, and had no constitutional symptoms. The Von Pirquet and Wassermann reactions were negative. In August, 1913, he weighed eighty-five pounds, and in July, 1920, he weighed one hundred and sixty pounds. The terminal stage leaves him a good functional hip, and he leads a very active life. He swims, dances, play base ball, foot ball and tennis. Physical examination seven years (July, 1920) after symptoms were noted, showed the great trochanter slightly elevated and prominent. There was one inch shortening; abduction, flexion, extension and internal rotation were slightly restricted. Fig. 5. (August, 1913): Roentgenogram shows a flattening, thinning and diminution in the size of the head and a moderate degree of shortening and thickening of the neck of the femur. The outline of the joint space is smooth and is not involved. The left hip is normal. Fig. 6. (July, 1920) taken seven years later, shows the terminal stage as a flattening and spreading of the epiphysis which is displaced slightly in all directions on the neck. The joint surfaces are smooth and not involved.

Conclusions

Osteochondral trophopathy of the hip-joint, Legg's disease, Calve's disease, Perthes' disease, etc., is a definite clinical entity, which should not be confused with other diseases of the hip-joint.

If Legg's disease occurs in other joints than the hip, it has not yet been recognized as such.

A number of conditions may be responsible for the disease, but it is generally conceded that sixty-five to seventy per cent of the cases follow an injury.

It occurs between the ages of five and ten, with an extreme range of two and one-half to twelve.

The course, symptoms, radiograms and end results are characteristic of this affection.

The treatment is simple and the prognosis good.

The disease is self limited and tends toward spontaneous cure.

Figure VII.—A case of Legg's Disease.

Figure VIII.—A case of Legg's Disease.

In conclusion, I wish to express my appreciation to Drs. J. M. Martin and C. L. Martin of Dallas, Texas, for their aid and instruction in the preparation of this paper.

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The Use of Radium Needles in the Treatment of Cancer*

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I AM almost ready to believe that any case of cancer can be cured. Whether or not any particular case is cured, depends, more than any other thing, upon its ready accessibility to agents at our command.

Of all agents which have been used in the past, surgery has certainly held the center of the stage. The prominence given the knife has not been through any inherent efficiency, but for lack of a more efficient agent at our disposal. However, radiation therapy has advanced so rapidly in the last few years in the treatment of this disease that cancer should no longer be considered a surgical disease.

Surgery still has its place, but it should be considered as an adjunct to radiation therapy. The one inherent weakness of the surgical method is that it opens up the lymphatic vessels and allows the cancer cells to escape into the surrounding tissue. Entirely too much healthy tissue is always sacrificed in the surgical treatment of this disease.

Radiation therapy blocks the lymphatic vessels, preventing the escape of the cancer cells; moreover, it can be used over large areas, without seriously injuring the tissues treated.

In the treatment of cancer by radiation, whether by x-ray or radium, two things are necessary: First, the lymphatics draining the diseased area must be closed, and second, the cancer cells must be destroyed.

Blocking of the lymphatic system is accomplished comparatively easily with the x-ray, which I believe is preferable. Radium will accomplish this result, but its application over a large area is rather slow and tedious. In giving these treatments with the x-ray there is very little danger of injuring the skin if reasonable precautions are taken. The second step, that of destroying the cancer cells, is, however, not a simple procedure.

Any cancer cell can be killed, either by x-ray or by radium. Our problem is to expose the cancer to sufficient radiation to destroy the cells, but not

*—Read at the Annual Meeting of The Radiological Society of North America, Chicago, Dec. 7, 1921.

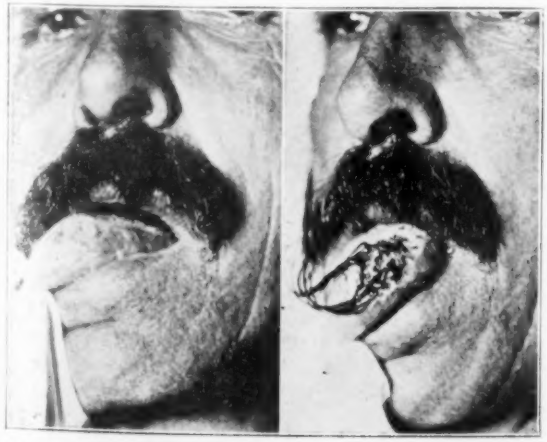

Figure I.—Cancer of the tongue one and one-half inches long and one inch wide. Was electro coagulated after injecting procaine. Fifty milligrams in five needles were inserted, through the base of the burnt tissue and left five hours. At the end of two months, completely healed.

Figure II—Cancer of the lip, with some thickening of the glands of the neck. Heavy x-ray treatments over the lymphatics of the neck, with electro coagulation and insertion of radium needles. Complete recovery.

Figure III.—Cancer extending through the cheek. There was a growth on the in ide of the cheek, similar to but only about one-third as large as that on the outside. Both the inside and the outside were treated by electro coagulation burning the tissue down. Radium needles were then inserted, as shown above. Healing took place without perforation. At no time was there any opening through the cheek.

Figure IV.—Extensive involvement of the lower lid, extending back into the orbit. Tissue was thoroughly destroyed by electro coagulation and curretted away. Seventy milligrams, in seven needles were evenly distributed throughout the tissue. Later it was found necessary to enucleate the eye, patient doing nicely at the present time.

to injure the normal tissue beyond its ability to recover.

The one tissue which stands in our way more than any other in the treatment of this disease is the skin. It is well known that some cancer cells require more radiation to kill them than the skin can reasonably stand. This led to cross-firing, or treating the disease through several different skin areas. This proved satisfactory in some cases, but not in others. Removing the skin over the diseased area is unnecessary and should practically never be done.

Our problem is to give the cancer cells a death dose, or we might say, give the cancer cells the largest dose of radiation from which the surrounding healthy tissue will recover. This can best be accomplished by using a combination of x-ray and radium, giving x-ray on top of the skin, all it will stand, and radium underneath the skin to the limit of what the deep structures will stand. Or we might say, x-ray from without in, and radium from within out. In this way the cancer cells are caught within a cross-firing from which few will ever escape.

How big a dose of radiation should be applied, and when? Biologists and pathologists tell us that certain types of cancer require a larger dose to kill the cells than others, but I have not always been able to judge correctly just which case is which. Sometimes the apparently simple cases prove to be very stubborn. Not always being able to judge beforehand, I give my cases the largest dose which the surrounding tissue will recover from.

When to give the treatment: I am coming more and more to believe that the maximum dose of radiation should be applied as early as possible, in practically one treatment. Not necessarily in one treatment, but close enough together that the cells do not recover between treatments. The sooner we kill, or, I might say, the shorter the time required to kill the cancer cell, the more likely we are of eventually curing our patient.

If we do not see a really wonderful improvement in four to six weeks, I feel that our chances of curing the patient are not very good. Our best results have really been spectacular. If we are going to cure our cancer patient, we must do it, and get it over with. Give the patient all the x-ray he can stand, either at once or over a period of four weeks. "Give," I might say as they did during the war, "till it hurts," and then stop. The practice of giving treatments once a week, or every two weeks, over a long period of time, is all wrong. The normal tissue will stand large doses of ray over a short period of time, but will not stand even small doses indefinitely. We all know this, few of us practice it. These cases must be treated almost as a surgical case would be treated, the cancer

Figure V.—Extensive involvement of the eye and orbit. The eye was enucleated and all the involved tissue destroyed by electro coagulation. Eight needles were imbedded as shown in the radiograph. Completely healed, no recurrence.

Figure VI.—Fibro-Mixoma in front of ear. Had been operated twice. Heavy treatment on the outside, with one hundred and fifty milligrams, in fifteen needles, imbedded on the inside, for five hours. There was considerable reaction, which subsided at the end of three weeks. Tumor promptly melted away.

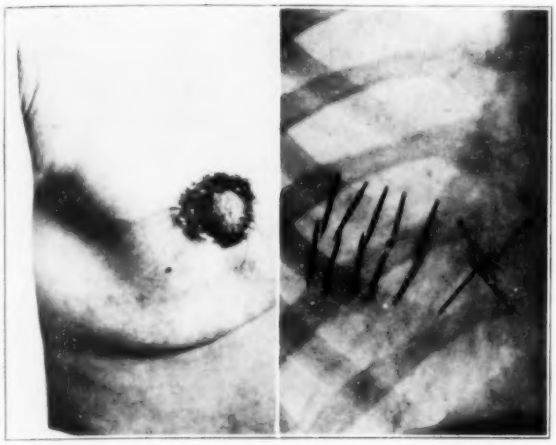

Figure VII.—Paget's disease, with deep involvement. There was a mass to the right of the nipple, about three by two inches. One hundred and forty milligrams, in fourteen needles, were imbedded, as shown in the radiograph, and left in place for five hours. This was followed the same day by heavy x-ray treatments over the breast and glands draining it. Completely healed. Later there was a slight recurrence, which is being treated by x-ray, at the present time.

Figure VIII.—Cancer on the inside of the mouth, involving the cheek, gums of the lower jaw and roof of the mouth. Heavy x-ray treatment over the outside, with electro coagulation and ten radium needles on the inside which were left in place for four hours. At the end of two months, a slight recurrence was treated in the same manner. Completely healed at the present time.

cells being destroyed *in situ* by radiation rather than being cut out.

Long continued treatments may apparently remove the tumor, but the tissues may be so weakened that we get what might be called a reversal of the tissue, and the disease spreads like wildfire. We have seen cases where we thought the patient almost well, when perhaps small nodules began to develop, or the tissue broke down, and away went the patient. The condition reminds me of what happens in a storage battery if strained too much when nearing its discharge point, the polarity changes and away goes the battery.

So to apply the dose of radiation which will destroy the cancer cells within the shortest space of time, and yet not do irreparable damage to the normal tissue, I proceed as follows: All the diseased and surrounding tissue, together with the lymphatic vessels draining the area, are given all the x-ray the skin will stand, with heavy filtration; cross firing is used whenever possible. From six to ten millimeters of aluminum, with leather, are used as filter; nine and one-half inch back up; five milliamperes, at ten inches distance, for from twenty to thirty minutes. This dose is followed either the same day, or the next, by the use of radium inserted into the deep tissues.

Radium needles of ten milligrams each are inserted deep into the cancer tissue one centimeter apart and left for a period of from five to ten hours, the time depending upon the kind of tissue, generally speaking, as to whether it is hard or soft; if the tissue is soft and boggy and almost ready to break down, five hours, or even less, is sufficient.

The insertion of radium in the form of needles is a surgical procedure and should only be undertaken by one who has had a surgical training. Most of the operations can be made under local anesthesia; however, a strict aseptic technique must be followed. Cancers which are infected break down readily and do not do well.

The manner in which the needles are placed in the tissues must be worked out for each case. It is important to see that the needles are not "bunched," thereby over-dosing a part of the tissues. I make radiographs of all cases so as to show the distribution of needles within the tissues. This is particularly important in mouth cases, so as to be

Figure IX.—Swelling of the left lower jaw, with extensive destruction of bone. Heavy x-ray treatments over the outside, with one hundred and fifty milligrams of radium, in fifteen needles, imbedded into the cancerous tissue through the mouth, as shown in the radiograph. At the end of one month, several pieces of bones were removed from the inside. At the end of two months, odor practically stopped and patient gained considerable weight. Is steadily improving.

Figure X.—Patient had previously had cancer of the lip, with recurrence under the jaw. Heavy x-ray treatment, with fifty milligrams of radium, in four needles, imbedded for five hours. At the end of two weeks nothing could be felt. It is remarkable how rapidly these recurrences in the neck will disappear, under the combined method.

sure that none of the needles have become dislodged and swallowed, where they might burn the esophagus and later result in a stricture.

The preparation of the radium needles is important, but I fear that sufficient attention has not been given this subject. Above all, the needle and its thread must be sterile; this can be accomplished by placing them in alcohol, but better yet, they can be boiled. And there is no reason why radium needles cannot be boiled, provided they are not allowed to boil dry; and where is the man who is going to allow, for instance, $18,000 worth (only fifteen needles) to boil dry.

Perhaps more important than even the sterilization of the needles is their preparation. We have had a long list of martyrs to the cause of x-ray therapy, and I hope we will profit by their fate and be more cautious in the handling of radium.

If we but remember that each little innocent looking radium needle is full of potential harm and ready to "go off", so to speak, at the slightest touch of the trigger, then, and only then, will trouble and suffering be avoided.

How are we going to thread, say fifteen needles, and what are we going to put them in while being sterilized, and how are we going to keep the threads from becoming tangled, and how are we going to get hold of them with the imbedding forceps, and, above all, how are we going to protect the operator while all of this is being done?

A simple contrivance has been worked out which answers all the above requirements for the handling of the radium needles. It consists essentially of a lead block into which holes have been drilled to a depth which will allow the eye to protrude when the needles are inserted. The needles are placed into their respective holes and can then be threaded without any trouble, the thread being held with a pair of forceps. The lead block protects the operator while the needles are being threaded. Projecting some five or six inches from the block is a brass frame, which serves as a carrying handle, and into this frame slots are cut which serve to hold the thread from each needle separately. A part of the lead in the block is cut away so that the sterilizing fluid will have ready access to the needles.

After the needles are placed in the holder and threaded, the entire container is placed into a deep glass dish filled with alcohol, or it may be boiled.

When a needle is wanted for imbedding, its thread is loosened from the slot, and the needle lifted part way out of its hole by the thread. The needle then can readily be grasped with the imbedding forceps. The use of this apparatus certainly simplifies the use of radium needles, and at the same time protects the operator, which is quite necessary if we are to continue our fight against cancer.

Figure XI.—Patient had a large sloughing mass on the back part of the tongue. Four radium needles were inserted into the base of this mass, from behind forward. Insertion of these needles was extremely difficult. A radiograph was then made, as in all cases, and one of the needles was found to be lying in the esophagus, from which place it was immediately removed and reinserted. The importance of taking x-ray pictures of all mouth cases where needles have been imbedded cannot be overestimated. Patient made a perfect recovery.

The X-Ray as a Microscope*

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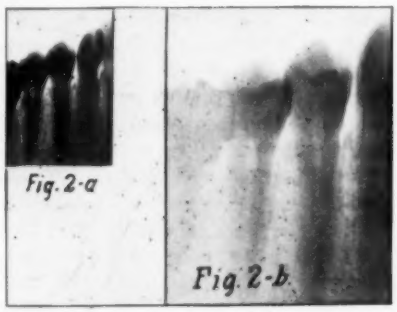
IT is not my intention to attempt a paper on research, or to endeavor to present new facts, but rather to analyze and call attention to certain data well known to all of you. The field of the roentgenologist is growing so large and assuming such proportions, that a discussion of the general principles involved may be of value. In fact, I feel that such a discussion is becoming necessary. I am surprised every day at the lack of knowledge of the field of roentgenology evinced by the medical profession. We have been so busy making new discoveries in our line, that we have overwhelmed the medical profession and the laity with mysteries without giving them the basis of our work.

The discovery of the x-ray by Professor Roentgen in 1895 followed as the proper sequence to the scientific investigations of several men. In 1858-59, Heinrich Geissler began his experiments with the vacuum tube. The first tube was of comparatively low vacuum (about 0.0025 mm.) and the electricity discharged through it produced a delicate glow. Geissler discovered that in the pressure vacua of different gases, the electrical discharge was very different from that of air; also that the electricity was sometimes striated and varied much in form and color with the degree of exhaustion and the composition of the gases. In 1860 Hittorf followed with the discovery that the luminous stream could be deflected by a magnet.

Then came Crookes, to whom, it is probable, belongs most of the credit for the preliminary work which made the discovery of the x-ray possible. He devoted himself to the production of a high-vacuum tube, and achieved one in which the pressure of the residue of air was about one ten-millionth of an atmosphere. With this tube he discovered new phenomena. He found that with a sufficiently high vacuum, the illumination glow within the tube disappeared, and he demonstrated that there was a rectilinear radiation from the cathode which was a production of particles of highly attenuated gas at exceedingly high velocity, about two hundred and fifty thousand yards per second. He called these rays *cathode rays*, and spoke of the condition of the gas in this highly rarefied state as the "fourth or radiant state of matter." Crookes also discovered that the rays could be intercepted by metallic plates within the tube, and that the impact of the rays against the walls of the tube produced a greenish phosphorescence or fluorescence and increased the temperature.

The next step was the announcement by Hertz in 1887 that when ultra violet light falls upon a spark gap, the discharge is facilitated; and again in 1892, that the cathode rays would penetrate gold-leaf and other thin sheets of metal within the tube. After his death his work was carried on by his assistant, Lenard, who discovered that many of the phenomena of the

*—Read at the Annual Meeting of The Radiological Society of North America, Chicago, Dec. 9, 1921.



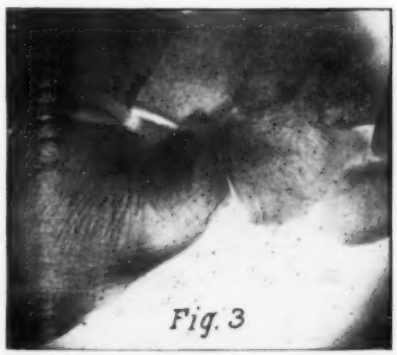


Figure I.—(a)—Reproduction from an ordinary dental film, with sharp detail.

Figure I.—(b)—Ordinary photographic enlargement from Figure I.—(a), as is commonly used in the study of minute detail.

Figure II.—(a)—Reproduction from ordinary dental film with small amount of blurring.

Figure II.—(b)—Enlargement from Figure II.—(a), illustrating the necessity of sharp definition for enlargements.

Figure III.—Pin-hole radiograph of skeleton foot with bones lying in apposition to film.

Figure IV.—Pin-hole radiograph made of same skeleton foot as in Figure III. The bones are here placed eighteen inches from film, thus cutting the direct rays from pin-hole, so as to produce the desired enlargement and yet retain detail.

rays could be observed outside the tube. He experimented with a tube closed at the end opposite the cathode with a thin sheet of aluminum, and found that the rays traveled better in vacuum than in air, that they produced phosporescence in suitable materials, would pass through substance opaque to ordinary light, and would affect photographic plates.

In 1893 and 1894 H. C. Jackson of King's College, London, came very near making the great discovery. He made known to the world one of the greatest advances in this field. It was he who discovered that a piece of platinum used as a track for the rays, instead of glass, increased the penetrative power and number of the rays, and also that a sharper shadow could be obtained.

It was to Roentgen in November 1895 that fell the honor of making the discovery of the x-ray. This series of discoveries has led to such great advancement in science and in the care of the sick that they must be placed among the really great discoveries in medicine, such as anasthesia and bacteria.

Following the announcement of Roentgen's discovery, the news was spread broadcast over the world and machines were established in all the larger cities. Many workers began to play with these rays, endeavoring to make pictures of the bones and of foreign bodies. The exposures varied from a few hours to a half day. The fluoroscope was also used extensively, and as a result of this and the long exposures many patients were burned, and the doctors received injuries which in many cases proved fatal. We are still seeing the results of that period.

Following this enthusiasm over the x-ray there came a period in which it was much in disfavor. This was to be expected, as equipment was very crude and inefficient, and the results disastrous, the practical value being offset by the danger. Science, however, came to the rescue furnishing more powerful machines—the exposure time was decreased and the efficiency increased. So that for the past ten years x-ray examination in disease has been steadily gaining ground. The bismuth meal was added in the diagnosis of the gastro-intestinal tract, and injection of the kidney was found to be of tremendous value. Portrayal of the diseased conditions of the lung by fluoroscopic examination and later x-ray plates was made possible. Gradually every part of the body and every known disease has been added to the list requiring x-ray examination, and every city and town has its large and small equipments. In spite of the scientific investigations which led up to the discovery of the x-ray, and in spite of the electrical science which made available the more powerful machines, the x-ray has been considered a magic crystal-glass into which one may look and see the revelation of all the diseased conditions of the body. Let us then strip off every vestige of glamour and illusion and leave only the bare facts. Such consideration will prove that the x-ray is a portrayal of living anatomy and its physiological and pathological variations. Given a knowledge of these three, plus an understanding of the x-ray, one may prophecy what the x-ray picture will be in any given case.

Our study of anatomy must not only be broad as to the various systems of the body, but detailed as to each organ. The knowledge of anatomy gained by x-ray study has been considerable, and has changed our opinions in many cases, as regards stomach and intestines, for instance. It is necessary to know the epiphyseal line of the bones and the size of the normal kidney. In cancer we can do little without a knowledge of the lymphatic nodes and their drainage. The anatomy of the lung is very intricate, and yet its most minute variations must be thoroughly understood. The consideration of the physiology may be illustrated by the heart, stomach or the growth of normal bone. The stomach has certain emptying powers, certain peristaltic waves, definite shape and tone, and any variation of these may be a key to the diagnosis. The small intestine is form-filled in the lower portion of the ileum and passes rapidly through the jejunum. The variation here often points to the appendix. The heart has certain known action, and it is possible to suspect the aorta or one of the valves by the changes in shape, size and action.

In the early history of the x-ray, it was attempted to diagnose only gross pathology such as fractures, foreign bodies, and large tumors. Now nothing is too minute or too intricate to be shown. The mistakes that I have made, I find, have been due to a lack of knowledge of pathology. We can climb no higher than our knowledge of pathology, and it is this branch of medicnie that tells us not only what to look for, but how to find it.

The practice of medicine, as well as every day life, is based upon facts learned by experience. The simple Eskimo coming into the Canadian woods, would have to be told that certain objects were trees. In like manner, the medical student is introduced to the rales of the chest. These observations are so ordinary that we consider

them as facts proven beyond doubt. And yet, how did we learn that a certain sound in the lung was a rale? If a patient comes in with loss of weight, cachexia, lack of appetite, indigestion, and a mass in the pit of the stomach, we consider it certain that he has cancer. Analysis of our conclusions shows that experience and observation have taught us that such a combination of conditions invariably points to cancer. The pathologist has made a prolonged and detailed study of all the various tumors of the body, and he is able, often, to state the kind of tumor from its gross appearance, and still more accurately from a section. In other words, he has found from experience, that a tumor of certain definite characteristics usually belongs in a certain definite class, and that it keeps these characteristics of the parent tumor no matter how far afield it may wander.

This same basis of reasoning is fundamental to the roentgenologist, and is decidedly within his province. In a complete examination he may make general deductions as to the pathology, just as the pathologist does from his gross examination, and also specific statements of findings in regard to any one part or organ. The general deductions, no matter how correct nor how much they are affecting the health of the patient, may not be the patient's chief complaint. The clinical history adds this necessary information, and is usually conceded to be within the field of the internist.

Our knowledge of the x-ray must be such that we will know what will be recorded upon an x-ray plate, and how to obtain it; that is, the rays have certain qualities and travel in certain directions and under definite conditions will portray any part of the body in its true likeness. The actual operation of the apparatus is entirely another matter, and is the true work of the technician.

May I, at this point, express my conception of the technician? Primarily, I feel the technician should be familiar with electricity, the running of an x-ray machine, and the x-rays as delivered by that machine. Likewise, he should understand the chemical phenomena that take place in a dark room and their general management. This requires intelligence and considerable scientific training. It is a position of great responsibility, inasmuch as it controls the quality of work done in the laboratory and relieves the roentgenologist of a tremendous burden. Familiarity with certain positions and the knowledge of correct exposure are also necessary requisites. If the technician is to leave this scientific field and offer interpretation of the anatomy shown upon an x-ray plate, together with its physiological and pathological variations, he is then entering directly into the field of medicine. Not only that, but he is dealing with the fundamental subjects of medicine, and if he has sufficient knowledge of these subjects to draw conclusions from the x-ray plates, then I am in favor of giving him the doctor's degree. It is true that anyone interested in science can learn a great deal about the human body from his associations in an x-ray department, and it is equally true that one can study the subjects of medicine without attending a medical school. But such courses are not recognized by the medical profession at the present time. I claim that it is as necessary to have a knowledge of medical subjects in the interpretation of x-ray plates as it is to make a physical examination of the chest and interpret the sounds heard through a stethoscope. The stethoscope does not whisper "pneumonia" or "tuberculosis," but gives a sound recognized as a rale, which the internist from experience and study interprets as certain forms of congestion. This same reasoning and intelligence must be used in the study of an x-ray plate. If the roentgenologist will do the work of which he is capable he need not fear the technician. The evolution of the x-ray and education of the medical profession and the laity through propaganda will give him his true place. Regulation of the technician through a licensing board may be of help, but without the education of the medical profession and the laity, I feel that it would be a failure.

In the study of an x-ray photograph our first approach is that in regard to its general aspects. We note first whether it is a good picture correctly portraying the anatomy. A good picture has not only visible qualifications, but intrinsic values. Our next consideration is that of the gross pathology; any considerable area of disease is noted which will lead to general deductions. The older roentgenologists have been especially skilled in studying gross pathology and have been able to give certain shadows a place in the diagnosis, which others would overlook. The clinical history should be used as *the* guide to the taking of the picture, and in its subsequent study, as a teacher of what we have overlooked.

After general consideration of our material we often find it necessary to make a detailed study of some of the anatomy as portrayed. This study must often be very painstaking and a careful search made for any physiological and pathological change. The information so gained may be the key to the diagnosis, and give us the etiological factor. This detailed study when often repeated leads us to desire better plates, more accurate portrayal of pathological conditions, and the ability to more closely study minute pathological conditions. The roentgenologist often uses an enlarging lens in this search, and several have stated that they are able to make more accurate diagnosis by enlargement, especially in the study of bone conditions. The question we then ask ourselves is, "How far will we be able to go in this study of enlargements?" Certain parts of the body yield themselves well to x-ray photography, and it is reasonable to assume that if we can properly control the rays we will be able to get pictures of greater intrinsic value and ones which will lend themselves more readily to enlargement. In the study of enlargements, I have found it hopeless to attempt anything with a blurred image, but one of sharp outlines can be magnified until the grain of the emulsion begins to show. We then have three main considerations:

First, the rays coming from the tube and their ability to cast a sharp shadow upon the plate;

Second, the ease with which the part of the body yields itself to photography;

Third, the limitations of the emulsion.

A few experiments in regard to the first may be of interest. We have only of late fully appreciated the part which the focal spot of a tube plays in the taking of an x-ray picture. Dr. Coolidge has given us a wonderful tube and focal spots of varying sizes, according to our needs. The rays coming from these tubes are not, however, under perfect control and cause more or less blurring of the image. A diaphragm with a pin-hole measuring one mm. as an opening was used beneath the tube; after various experiments with different tubes and different distances we came to the following conclusion:

First, that such a diaphragm cut off all undesirable rays from the tube and allowed those to pass through that were traveling in straight lines from the focal spot to the plate.

Second, that the size of the circle of radiation was increased as the pin hole was brought nearer to the focal spot.

Third, that the size of the circle of radiation was directly proportional to the size of the focal spot, that is, the larger the

focal spot the larger the circle of radiation.

Fourth, that the quality of the rays was not changed and the time of exposure was in the direct proportion of the size of the pinhole to the size of the focal spot, that is, the broader the focal spot the longer the exposure, as fewer rays really passed through the opening.

Five, that an object placed at varying distances from the plate would be enlarged in proportion to the distance from the plate.

Sixth, that some focal spots gave off different quantities of rays from various places on the focal spot and cast shadows of varying densities.

It would seem possible to have such a diaphragm close to the anode, giving us a sufficiently large area of exposure to be used practically. The danger of exposure would be no greater, as the quantity of rays coming through such an opening is correspondingly less. An object could then be placed at varying distances from the plate and enlarged as desired. This image could be studied still further with a hand lens to the limit of the emulsion. With the advent of still larger apparatus and the control of the secondary rays, which will eventually be accomplished, we can expect x-ray photographs of great intrinsic value.

DR. PARISEAU: I believe that we owe thanks to Dr. Wasson for calling our attention to one aspect of radiography that has been too much neglected—the fact that it acts as a microscope. We are greatly jeopardized by secondary radiations, but we can get around them with a small diaphragm. One should work with a slow plate and not the ordinary radiographic plate. The emulsion in this case is too coarse to allow any magnification. I have found that certain plates like the imperial fine grain ordinarily have the same speed as x-ray plates and they are much less grainy for this kind of work. I think you would find under the microscope or enlarging glass, an emulsion much less grainy.

I think we shall have in time a developer that will be quite fluctuating. Then with a tube removed sufficiently far away and all secondary radiation suppressed, I think we can push that idea of yours farther still and get practically microscopic enlargement. We might call them photomicroradiographs.

The point I wish to emphasize is that by sacrificing a little speed, using slower plates when it can be done (it can be done for bone study), we get around the graininess of ordinary x-ray plates. I believe there is a line of research that we should all go into, that is, microphotography by the x-ray.

Some of the Less Common Uses of X-Ray Therapy*

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Toronto, Canada

JUST as in much of our general medical work there is a tendency sometimes to devote too much attention to rare and unusual diseases to the exclusion of the common, every-day afflictions of the human frame, so in the stress of the great period of advancement we now find ourselves experiencing in roentgenology we may overlook some of the more homely uses of our wonderful agency. Therefore, this short paper is offered to call to our minds several diseases in which great things can be accomplished without first having to determine to the third decimal point the number of Angstrom units being produced by our particular apparatus at that particular moment.

The chronic or sub-acute infections are so many and varied and occur under such a variety of conditions that it would be impossible here to refer to them in detail, and yet it is the writer's opinion that almost any type of chronic infection will receive some degree of benefit from stimulating radiation. There are many, however, in which the results are so definite as to appear specific in their effect.

CARBUNCLE

The successful treatment of carbuncle by x-ray dates back almost to the earliest days of x-ray therapy, and yet so little has been said in our literature regarding it that operations are still being performed for this condition. There is probably no more satisfactory result in radiotherapy than the manner in which the average carbuncle responds to treatment, and the percentage of cures is so high that it should certainly be tried out in every suitable case.

Judging entirely by results, I would divide carbuncles into two main groups: (1) Those occurring upon the back of the neck. (2) Those elsewhere on the body.

In the first group treatment is helpful, but results are slow to appear and not very definite until the "core" has separated, after which healing is rapid. The general course of the disease is probably not greatly altered by treatment.

It is with the large spreading carbuncle upon the trunk, usually the back, that the best results have been obtained. These patients practically always present themselves for treatment after several craters have formed and are discharging pus, and at the same time the lesions are all extending and are very painful. In most cases the surgeon is contemplating a complete removal of the area and antiseptic compresses have been tried without avail.

We have never up to the present had to give more than two treatments to such a carbuncle, and usually only one. The technique followed has been satisfactory, but no doubt some other would serve equally well. The infected area is treated in one single large area and is given three-quarters of an erythema dose unfiltered. This in our case is four milliamperes, ten inch distance, eight inch spark gap, three minutes. The pain will usually be relieved the same day, but in any case should not last longer than twenty-four hours. Improvement should also begin at once, but if necessary the same treatment may be repeated on the fourth day. Within a week the whole infection should be gone, and the area healed, or rapidly granulating upon a healthy base.

FURUNCULOSIS

If the furuncle can be treated in the very early stage, while it is still forming and before the occurrence of pus it is frequently possible to cause recession and prompt disappearance.

The patients who more commonly present themselves have suffered from chronic boils—usually for weeks or months, and have tried nearly every form of therapy from yeast to vaccines. In such cases we believe the disease can be dealt with more effectively by radiotherapy than by any other method and believe that it should be invariably recommended. It has been our custom to treat such cases both locally and systemically as follows:

The local treatment applied to the lesions is not different from that in carbuncle except that we give one-quarter of an erythema dose and repeat this each week until the desired result is obtained.

In addition, however, to treating the lesions directly we expose several large

*—Read at the Annual Meeting of The Radiological Society of North America, Chicago, Dec. 8, 1921.

areas of the trunk to the same dose, believing that in so doing we materially raise the phagocytic activity of the blood and improve the patient's condition generally. Of the effectiveness of this addition to the technique we have no doubt whatever but have had no opportunity to make any study of the mechanism or to establish its virtue other than by empiricism and the known effects upon the body of such irradiation.

Onychia and Paronychia

There is surely no more distressing minor infection than either of the above, and few things more intractable to treat under ordinary methods. They usually come after a prolonged period of antiseptic treatment with or without adequate drainage, and yet three exposures one week apart is the maximum amount of irradiation we have ever had to apply in order to secure complete cure of the condition. The technique is that used for carbuncles and repeated within four days to a week. We have also used the following with equally good results, but apparently not any better: five ma., two mm. aluminum filter, five minutes, ten inch distance, eight inch spark gap.

Chronic Sinuses and Fistulae

Chronic discharging sinuses, including tuberculous sinuses, respond well if the source of infection is in lymphatic, glandular or similar tissue, but no response has been obtained in fecal or urinary sinuses or fistulae. Up to the present the responses in sinuses in osteomyelitis have been very disappointing, owing apparently to a wrong selection of dosage in the treatment of chronic bone infections. This part of the subject is therefore omitted for the present.

But apart from these we believe the period of healing of many sinuses could be very greatly shortened by systematic irradiation. This statement is intended to include such sinuses as occur in empyema if the remaining cavity is not too large. One of our cases in this group, after having discharged continuously for over two years, closed within two weeks after the first treatment. This closure has been permanent. A large cavity will in all likelihood be uninfluenced, and in such cases we do not recommend treatment.

Cystitis

Our treatment of cystitis has been almost entirely limited to cystitis following supra-pubic cystostomy and prostatectomy. In such a case with a foul bladder and urine loaded with pus the improvement, which will occur in one or two weeks, is often very spectacular, and in several cases has been the means of saving life.

In addition to the operated cases, however, great benefit can be secured to the victim of enlarged prostate who has also an infected bladder.

It seems highly probable that some at least of the benefit from treatment of these cases is due to the effect upon the cystitis quite as much as to the effect upon the prostate itself.

A further result in operated cases appears to be a hastening of the healing of the sinus which closes much sooner than in untreated cases. Taken altogether, the benefit accruing to this type of patient is so great in the majority of cases as to justify a much wider use of this form of therapy.

In a former article the method followed in cases of enlarged prostate and cystitis has been given in detail. Here it need only be summarized as follows: A series of treatments which fall midway between the mild stimulating or superficial type of treatment and the more intensive irradiation has been selected and is applied through six portals of entry—three anterior and three posterior. One or two areas are given each day, depending upon the individual's reaction. In a few cases an additional perineal area is necessary, but not in the type of case here being specially considered. The technique employed has been five ma., eight mm. aluminum, ten inch distance, nine inch spark gap, fifteen minutes. Under these conditions there will be no skin reaction and the treatment may safely be repeated in three or four weeks. The results have been excellent, both as regards the cystitis and the prostate.

Otitis Media

In this disease our experience has been limited to a few cases, but has been decidedly encouraging, so much so that I feel justified in including it among the chronic infections in which beneficial results may be expected. More work is being undertaken along this line at the present in order to establish a more careful control of results.

There seems, however, to be a fairly high degree of uniformity in the improvement noted and the method deserves a a wide trial on its merits. The technique followed has been selected as a stimulating one: five ma., three mm. aluminum filter, ten inch distance, eight inch spark gap, five minutes. Both ears have been treated at one sitting, and treatment repeated every two weeks the average number of treatments required is five.

Chronic Pneumonia

Here, also, we are dealing simply with a chronic infection of a slightly different type and of a somewhat more complex character. But in other respects the analogy is very close. We are dealing with a chronic infection of lung tissue which has resulted in a semi-consolidation which refuses to undergo resolution. Two things are evidently required: (1) Stimulation of the activity of the local cells. (2) Elevation of the general phagocytic power of the body.

These, we believe, can both be supplied by x-ray treatment with the result that the period of convalescence will be materially shortened, and in a number of cases complete resolution obtained, where otherwise a most protracted and uncertain course would result.

There is no intention at this time of presenting case reports on this subject. The actual number of cases treated is not large enough to permit of generalization, but taken together with similar results in old chronic bronchitis, in some cases of bronchiectasis and other chest disabilities, it is sufficient to indicate that there is here a fertile field regarding which little has been written and much remains to be done.

In a similar manner we might discuss another group of diseases which we classify as arthritis and neuritis, but in which a low grade infection plays an important and often a predominating part. Two illustrations only will be taken: (1) *Sacro-iliac Diseases and Sciatica.* (2) *Tic Douloureux.*

Of acutely painful disease of the sacro-iliac region it has been our lot to have to deal with a considerable number. X-ray examinations have been negative, clinical findings negative, no relief obtained from strapping, braces, heat, light, electro-therapy or other physical methods. In many such cases permanent relief has been obtained by x-ray treatment. In those cases in which the pain also involves the sciatic nerve relief has been secured in a sufficient percentage of the cases to justify its use in all such cases which prove to be unresponsive to the ordinary methods employed.

In both these groups the routine employed has included the irradiation of the sacro-iliac joints and also the entire lumbar nerve roots on both sides. This, we believe to be of much more importance than treating the distribution of the nerve itself, which, of course, is also done.

Tic Douleroux

It is the writer's firm conviction that more help can be afforded sufferers from this terrible malady than is being accomplished, although it is admitted that few permanent cures will be obtained and many failures must be recorded. Some so-called failures have

later proved to be successful and have well illustrated the "delayed" effect which sometimes occurs in x-ray therapy and which only proves that we have been too easily discouraged.

One of our cases receives a treatment once every six weeks to two months, and this keeps him in complete comfort until about the expiration of the next interval; another patient receives an exposure every three months and has only an occasional spasm of moderate severity. Other cases have been entirely relieved, or so much so that treatment has been discontinued, while there have been sufficient failures to prove that too much need not be expected.

The object of this paper has been attained if attention has been secured to the exceedingly important role which x-ray therapy may be made to play in these two great groups of every-day diseases in which chronic infections of some sort play the chief part. While the exposition of it is not very scientific the usefulness of the method cannot be doubted, and the practical application is very simple and easily within the reach of all.

Post-Operative Mastoid Treatment with X-Ray*

CHARLES GOOSMANN, M. D.
Cincinnati, Ohio

IT is an old observation that patients with acute mastoiditis sometimes experience relief from pain and moderation of the discharge after the slight exposure to roentgen rays incident to making a few plates.

With this in mind, I have been trying since May 1919, the roentgen ray treatment of mastoid cases which were not healing properly after operation. Altogether, there have been ten cases, all of which had been operated, but still complained of pain or discharge, or both. In all of them the improvement was distinct and rapid, and appeared to impress the otologist very favorably. There must be many such cases in which roentgen ray treatment is indicated as an adjuvant, but is not used because its value is not generally known.

My oldest patient was fifty-one, while the youngest was only four years old. The postoperative interval before roentgen ray treatment was started varied from twenty-five days to five years.

The latter case, however, had a second operation about four weeks before commencing roentgen ray treatment, the otologist claiming some infected cells had been left by the first operator. Excluding this case, the longest interval was two years.

The first case had five treatments, but I have since had equally good results with two to four exposures, each consisting of half of an erythema dose, filtered through three mm. of aluminum.

While the explanation of how roentgen rays benefit these cases may not be very important, I started on the assumption that unhealthy granulations were the chief cause of delayed healing, and it is well known that such tissue is very sensitive to radiation, according to the law of Bergonie and Tribondeau. "Immature cells and cells in an active state of division are more sensitive to roentgen rays than are cells which have already acquired their fixed adult morphologic or physiologic characters." And Mottram has found that actively dividing cells are about eight times more vulnerable than resting cells, when exposed to radium.

This brings up the question of radium treatment in this type of case. The biologic effect, I feel sure, would be the same, and the radium might be preferable in a youthful patient who is afraid of the larger and noisier apparatus. The only disadvantage is the longer period of application. I had intended to use radium on my four year old patient, but he was so tractable that it was decided to give him the benefit of the quicker treatment.

The first patient in this series had a left mastoid operation and a right suppurative otitis media. Both sides were treated and both responded. Since then I have treated several other middle ear inflammations, but without any permanent improvement. It is possible, however, that selected cases of otitis media may also receive some benefit from roentgen ray treatment.

Discussion

DR. ISAAC GERBER, *(Providence, R. I.)*: The remarks of Dr. Goosmann are certainly interesting and point out a way to do some possible good. I have been interested in mastoid work from the diagnostic end for quite a few years and have seen quite a number of cases where there has been a delay in healing following operation. From my observations, and from conversations I have had with otologists, I judge there are, as a rule, two causes for this. One is a mechanical cause due to carelessness in the after-treatment, chiefly overpacking of the wound. That is a surgical fault which occurs in many other cases where the overpacknig prevents healing. That is the least common of the two factors. In the great majority of cases delay in healing has been found to be due to the fact that certain elements, chiefly diploee, are left behind in the mastoid at the time of the original operation. In many cases it was due to the fact that no preliminary x-ray study of the mastoid was made and the surgeon had no definite idea as to the actual anatomic distribution. He just went ahead and did blindly what he thought was a radical mastoid operation. Oftentimes there is a peculiarity in structure of the mastoid, so that collections of diploee are left behind, which could not be seen at operation without preliminary x-ray study. In a number of such cases I have x-rayed the mastoid after a more or less prolonged period of non-healing and found these cells. At the secondary operation the otologist went directly after these cells, cleaned them out and the mastoid healed up.

Aside from this group I think very likely there will be another definite group in which the cause is unhealthy granulation tissue, perhaps the result of a general infection which the patient has had for a long time. In these cases I can see where radiation treatment of some sort might be useful in breaking down unhealthy granulations and in stimulating the phagocytosis of the healthy cells. As a matter of fact, I believe healing there will be the same as that which occurs in an old tuberculous sinus. It is the stimulation of healthy cells that clears up the infection. Under those circumstances I believe there will be a definite place in the future for this postoperative mastoid treatment.

DR. CHARLES GOOSMANN *(Cincinnati, Ohio)* (closing): I have had no experience in the treatment of sinuses left by chronic osteomyelitis, excepting those of tuberculous origin. We have all had favorable results with tuberculous sinuses. Dr. Gerber says the effect is due to stimulation of the healthy tissues. I have always thought the beneficial results were due to a destructive action on the tuberculous granulation tissue.

*—Read at the Annual Meeting of The Radiological Society of North America, Chicago, Dec. 7, 1921.

X-Ray and Clinical Findings in Normal Chests of Children Six to Ten Years of Age*

THE National Tuberculosis Association some time ago began a new and important phase of its work in an attempt to increase the quantity and character of research work in problems related to its own field in the United States. For this purpose it appropriated $20,000.00 and appointed a small committee composed of Dr. Wm. Charles White, Medical Director of the Tuberculosis League of Pittsburgh; Dr. Paul A. Lewis, Director of Laboratories of the Phipps Institute, Philadelphia, and Dr. Allen K. Krause, Director of Kenneth Dows Research Fund, Johns Hopkins Hospital, to expend these funds to the greatest advantage.

This committee decided that the best use of these funds would be in assisting researches already under way that held the greatest promise of increasing the practical knowledge of physicians dealing with tuberculosis. This, they considered, would bring the greatest help to those suffering from tuberculosis and the greatest boon to the public from whom the funds were collected. This plan has been carried out in co-operation with the universities.

One of the researches was an effort to establish the x-ray and clinical findings in the chest of a normal child up to ten years of age. For this problem the National Tuberculosis Association nominated the following groups of roentgenologists and clinicians:

Dr. . K. Pancoast and Dr. H. R. M. Landis, University of Pennsylvania.

Dr. F. H. Baetjer and Dr. C. R. Austrian, University of Johns Hopkins.

Dr. H. K. Dunham and Dr. K. D. Blackfan, University of Cincinnati.

The signed reports of these physicians are here presented in two sections with the hope that they may promote a discussion which will be fruitful in establishing the truth in these two fields.

Section I.

The X-ray and Clinical Findings in the Normal Chest of the Child—Report of the Clinical Division of the Committee on Medical Research of the National Tuberculosis Association.

The value of roentgenography in determining the presence of pulmonary disease has long been recognized. Studies to determine the roentgenograms of various pathological lesions of the lung have been almost without number, yet much difference of opinion exists in the interpretation of findings, largely because no satisfactory observations have been made establishing the variations that may occur in the normal. To one observer shadows noted are indicative of disease, to another they are not evidence of a pathological process; to one they represent lesions of clinical significance, to another they suggest changes of no moment. The realization of this unsatisfactory state of affairs was widespread, but it remained for the Research Committee of the National Tuberculosis Association seriously to consider it and to set about to correct the shortcomings.

In the spring of 1920 that committee called together the collaborators in this work and instructed them to set about in ways of their own choosing to solve the problem, extended to them a financial grant, and in order that the problem might be a very definite one asked that the immediate study be limited to a consideration of the chests of normal children between the ages of six and ten years. The work was begun promptly and a preliminary report was made at the annual meeting of the Association in May, 1921. The findings at that time were incomplete and because of the then limited observations, no very definite conclusions were drawn. However, the practical need of a solution of the problem was apparent. Study was continued throughout 1921 and the first four months of 1922, and the data independently assembled were jointly discussed to evaluate them. Although each pair of workers carried on its investigations without inter-group consultation, although each approached the subject from a different angle, and when first met held views apparently not altogether in accord, it was agreeable to find that an exchange of conclusions disclosed almost an unanimity of opinion. The findings of these six observers—three clinicians and three roentgenologists—are presented to you for your consideration:

Theoretically, the normal child is one of ideal height, weight and development for his age, without subjective or objective evidences of deformity or of disease and without residual changes due to antecedent pathological processes. Practically, a normal child is one of average height, weight and development for his age, symptom-free and without signs of disease. Each such individual, in more or less relation to his age, will have been ill more or less often, and as a consequence may be expected to show variations from the ideal, not because of present disease, but as a result of residual changes that persist. An appreciation of these facts makes it apparent that the findings, clinical and roentgenographic, in normal children as we meet them will vary greatly from any fixed standards and still must be considered as variants of normal.

The clinical data dealt with in this report were obtained by careful examination of apparently healthy children between the ages of six and ten years. All children who showed signs of disease were excluded from the series. Individuals from various strata of society, foreign and native born, residents of urban and of rural communities, school children and children residing in institutions, children exposed to tuberculosis and some without a history of such exposure, children with and without a history of previous infectious diseases, all symptom-free, and of an approximately normal height and weight for their ages, were studied. A history of each individual was recorded and in making the examinations of the chest, care was always observed to have the child relaxed and to see that no cramped or unnatural posture was assumed, for, as is well known, faulty position may lead to findings that cause confusion in interpretation. In addition, a tuberculin test was made on every child. The clinical data were then assembled, and after the roentgenologist had interpreted his plate independently, the clinical and roentgenographic findings were correlated.

In all, over five hundred children were thus studied, and as a result some very definite conclusions seem warranted.

As in the adult, so in the child, vocal fremitus is more marked over the right upper chest than over the left.

It is generally stated that the percussion note elicited over the lungs of normal children within the age limits under consideration is fuller, more tympanitic, of higher pitch and more resilient than that noted over those of adults, and that frequently the tympanitic quality is quite outspoken, especially over the lower lobe of the left lung. Although in general our observations confirmed this view, we have been impressed by the fact that in an appreciable number of such children, the note obtained on percussion over the

*—National Tuberculosis Association Medical Research.

lungs is indistinguishable in quality from that elicited over the lungs of normal adults and that the usual resilience of the note is lacking. These findings in many instances have an analogue in shadows noted in the x-ray films, shadows indicative of increased density along the bronchial tree, similar to those seen in the plates of normal adults. This correlation of the findings on physical examination and on x-ray study is more constantly possible in studies of the upper half of the chest. When minor changes similar to those discovered by x-ray examination of the upper lobes, occur in the bases, they usually escape detection on physical examination. In those instances, in which no shadow is found to explain the deviation of the note from the generally accepted one, it is our belief that the lack of resilient quality may be due to a decreased elasticity of the chest wall.

The so-called tympanitic quality of the percussion note over the left base may be increased, decreased or be entirely lacking, depending upon the degree of distention of the stomach or colon, the curvature of the spine, and may likewise vary with the position of the diaphragm or with the posture of the child during the examination. The note over the upper thorax is often the same on the two sides. Kroenig's Isthmus averages 5 to 6.5 cm. in width. The lower margins of the lungs posteriorly are at the level of the tenth or eleventh rib and descend from 1.5 to 3.5 cm. during forced inspiration.

A just detectable diminution of resonance over the apical regions is of no significance unless associated with a modification of the breath sounds in those areas or with other abnormal ausculatory findings.

It is generally accepted that normally in childhood the breath sounds have a harsh, sharp character with expiration longer and better heard than in the normal adult. This so-called puerile breathing is physiological and though it may seem trite, let it be emphasized that this exaggerated vesiculobronchial respiratory murmur, especially well heard in the areas overlying the great bronchi (that is, anteriorly at the level of the first interspace and the second rib just lateral from the sternal margins, and posteriorly, particularly on the right side, at the level of the second and fourth spine) is often incorrectly interpreted as evidence of pulmonary disease. An auscultatory finding that has not been pointed out, or at least, has not been emphasized, has come forcibly to our attention in carrying out this study. Just as the full, deep note or higher pitch characteristically elicited by percussion of the child's chest is often replaced in health by a note more like that produced when one percusses the normal chest of an adult, so, on auscultation of a child's normal lungs, the exaggerated or puerile breath sounds may be lacking, and instead the so-called vesicular respiratory murmur characteristically present in adult life is heard. This finding, regarded by us as a physiological variation, has been noted as early as the age of four years and may perhaps occur in younger children. It is more readily appreciated and more often found than the variation in the percussion note just described. In more than fifty per cent of the children in which this type of breathing was heard, examination with the x-ray gave findings like those obtained by a study of normal adult chests. In fact, the agreement of clinician and roentgenologist was so constant that we have come on the basis of these variations to designate the chest of normal children as of "puerile" or of "adult" type. The essential fact to be stressed is that so-called vesicular respiration is heard with great frequency in normal children, and is to be regarded as a variation of normal and not necessarily as an indication of disease.

These variations and those of the percussion note are more generally found in children with a history of infections of the respiratory tract. No satisfactory explanation for this finding is offered. It may be due in part to altered resilience of the chest wall, a suggestion supported by the fact that in some instances in which it was noted, diminished elasticity of the thoracic wall was apparent on percussion. It may stand in relation to variations of elasticity of the parenchyma of the lung. It may be due to a relative narrowing of the lumen of the bronchial tree. It is hardly to be considered evidence of increased density of respiratory tissue, for, theoretically, at least, that should lead to a modification towards bronchial breathing.

Concerning the whispered voice sounds, little comment needs to be made other than to emphasize their loud transmission often with syllabation over the region of the major bronchi. Auscultation of these sounds over the upper thoracic spine of the children has led to the conclusion that D'Espine's sign as indicative of enlarged tracheobronchial lymph nodes is, to say the least, of doubtful value. In twenty-three of the children, this sign was elicited without other signs of a mediastinal mass and without any corroborative evidence on x-ray examination. In three, the sign could not be elicited, although from the x-ray plate it might have been inferred that it should be. Eustace-Smith's sign is so generally present in normal children that it is of little or no practical diagnostic worth. The presence of these two signs, together with impairment of resonance in the intercapsular region is all too frequently made the premises for a diagnosis of tuberculosis of the tracheobronchial lymph nodes. This is unwarranted, for, as indicated, these signs are unreliable evidence of a pathological condition, and the determination of a diminution of resonance in the interscapular region requires such a nicety of technic that even masters of percussion disagree as to the presence or absence of significant findings in this region of the chest.

A year ago, in the preliminary communication to this society, we stressed the importance of the role that antecedent infections might play in the production of areas of increased density within the respiratory tract (bronchial tree, parenchyma of the lungs, etc.) This fact is re-emphasized, for further study has established the importance of it. Not only may recognized or remembered infections of the bronchi and lungs be responsible for alteration in these tissues, but other diseases not ordinarily considered of significance in this regard may be causal of such changes. For example, our observations indicate that after measles, pertussis or tonsillar infections areas of increased density, radiating from the hilum into the bases especially, occur with great frequency. Such lesions generally are not discoverable on physical examination and would be unsuspected but for the use of the x-ray. They are referred to in the clinical part of our joint report in order to point out the need of a careful history as well as examination in all individuals, before proceeding finally to interpret the findings of the roentgenologist. By way of digression, it may be interesting to point out the fact that though measles and pertussis have been known to produce lesions in the upper air passages, involvement of the lower tract has been considered a complication and was thought to occur only when evidence of bronchitis or of broncho-pneumonia were discovered. Our observations indicate that there may be a mild inflammatory process throughout the respiratory passages in a large percentage of the so-called uncomplicated cases of these diseases. This suggestion warrants further study in relation not only to the infections under consideration, but also other infectious diseases. That such shadows, mediastinal and basal, noted in children who

give a history of uncomplicated measles and pertussis, are evidences of healed processes is evidenced by the experience that similar shadows of like origin have remained unchanged and without the development of clinical symptoms in a series of children observed from three to five years. Such changes must be properly evaluated as indices, not of present disease, but of lesions past and healed, not as warrants for the diagnosis of present illness and the institution of treatment, but as scars of infections met and overcome.

Most of the children included in this study were tested with tuberculin —some were given a cutaneous test with old tuberculin (Pirquet), others were tested by the intracutaneous method (Craig).

The foregoing facts have been detailed at some length to establish the major thesis that, clinically, the ideal, normal child is a hypothetical impossibility. Children, apparently healthy, symptom-free and active, show on careful examination many deviations from fixed standards, variations that must be interpreted as within physiological limits; standards of height and weight must be elastic; measures of resonance and of resilience of the chest must not be rigid, and estimates of acoustic phenomena must permit of a range of difference from the ideal. These facts, clinical experience establishes beyond peradventure, and they suggest a corollary, namely, that x-ray examination of the chest of such children may be expected to show comparable deviations from a fixed ideal roentgenogram.

The studies reported, fortified by past experience, warrant the following conclusions:

(1) The data obtained on percussion and auscultation of the lungs of normal children show wide variations from a fixed standard. These variations are usual and are considered to be within normal limits.

(2) Inasmuch as the changes referred to are dependent often upon alterations that persist as the residua of past infections of the respiratory tract, it is obvious that a careful anamesis, with special reference to all infections, is necessary if diagnostic errors are to be avoided. Even a history carefully taken is often unreliable, as minimal infections are soon forgotten by many, and among the unintelligent classes even more significant indispositions are not readily recalled.

(3) Failure properly to evaluate these deviations from a fixed standard will often lead to the unwarranted diagnosis of disease and to even less justifiable treatment.

(4) With a proper appreciation of the widest variations that the normal may present from the ideal, the informed clinician is better able correctly to understand the findings of the roentgenologist, and each, co-operating with the other is less liable to error.

(5) D'Espine's sign as indicative of enlarged tracheo-bronchial lymph nodes is of little value.

(6) Recognition of and familiarity with the foregoing data is of cardinal and practical importance to every patient, potential and established. Without a proper appreciation of the facts set forth, no intelligent differentiation between a normal and an abnormal respiratory tract can be made.

In brief, to establish the presence or absence of disease, it is imperative that all data—clinical, laboratory and roentgenographic—must be evaluated and correlated and that no one fraction of the evidence be stressed to the exclusion of the others.

(Signed)—C. R. AUSTRIAN
H. R. M. LANDIS
KENNETH D. BLACKFAN

May 6, 1922.

SECTION II.

The X-ray and Clinical Findings in the Normal Chest of the Child—Report of the X-ray Division of the Committee on Medical Research of the National Tuberculosis Association.

It is generally conceded that one of the most important factors in accurate interpretation of the appearance of morbid processes in the roentgenogram of the thorax is a thorough familiarity with the normal and variations therefrom within normal limits. With a full realization of this in view, the National Tuberculosis Association in 1920 appointed a committee comprising three roentgenologists and three internists to make a study of the normal chest of the child between the ages of six and ten years. This group was instructed to work in co-operation and to make a report of their investigations before the Association when their studies were completed and their conclusions reached. The members selected for the committee were Dr. H. Kennon Dunham of Cincinnati, Dr. Frederick H. Baetjer of Baltimore and Dr. Henry K. Pancoast of Philadelphia to act in the capacity of roentgenologists and to work in co-operation with the respective internists in the same cities, Dr. Kenneth Blackfan, Dr. Charles R. Austrian and Dr. H. R. M. Landis. Each group of two was to work independently until a satisfactory number of individuals were examined, and the entire committee was then to meet and draw their conclusions for presentation. It was to be the duty of the internist in each group by careful clinical study to select as nearly normal children as possible for examination by the roentgenologist. The entire procedure was to be carried out with strict co-operation between the two members of each group.

It was soon realized by the x-ray members of the groups that an attempt to describe a normal chest was practically impossible. Their endeavors soon began to center around the description of a theoretical normal with wide variations that would serve as a basis for the interpretation of abnormal appearances and tend to preclude the possibility of erroneous diagnoses being based upon faulty interpretations of hilum shadows, trunk shadows and linear markings more or less altered in appearance by the frequent respiratory infections of children. They realized that herein had existed the greatest source of error in interpretation, and no doubt the Association had this same thought in mind when the committee was appointed to take up these investigations. Errors in interpretation have been made chiefly in connection with the diagnosis of pulmonary tuberculosis.

It was the consensus of opinion that children are probably more apt to show definite x-ray evidences in the hilum and trunk shadows of simple as well as serious respiratory infections than adults. Practically all children of the ages of those examined have had at one time or another one or more respiratory infections, especially measles and whooping cough, that are likely to produce very apparent changes in the shadows mentioned, and which will remain distinctly visible for a variable period of time. These apparent deviations from the normal are not necessarily abnormal when observed, but may be the harmless results of one or more infections. No doubt such appearances have many times been misinterpreted as evidences of tuberculosis. In the conclusions reached by the committee the attempt has been made to preclude this possibility.

Many of the general observations may not have been included in the conclusions. One of these perhaps worth mentioning is the fact that the heart of the child is found to extend relatively farther to the right than in the adult.

The thoroughness with which the studies were carried out may be in part realized from the number of individuals examined. Over five hundred children were selected from all strata of life, as stated in the clinical report of the committee.

The groups comprising the committee met at the Phipps Institute, Philadelphia, March 3, 1922. Prior to this meeting there were misgivings as to the possibility of an agreement upon any very definite conclusions, but much to the satisfaction of all the members a definite agreement was reached and the conclusions were completed after a few hours careful deliberation.

To assist in a better understanding of the conclusions of the committee, a composite diagram reproduction of several roentgenograms was made. It must be remembered that the three zones like the chest have thickness as well as length and breadth. Thus the zones extend anteriorly and posteriorly from the lung root as well as laterally.

Conclusions of the X-ray Division of the Committee

The Normal Chest. The normal chest of the child from the roentgenologic standpoint is subject to such wide variations within normal limits as to be beyond the possibility of exact description.

Hilum Shadow. The conglomerate shadow commonly called the hilum shadow, when found lying entirely within the inner third or zone of the lung area can be disregarded, or regarded as normal, except where it is made up of a solid mass of homogeneous shadow giving undoubted evidence that it represents a growth or mediastinal pleurisy.

Calcified Nodes. Calcified nodes at the root of the lung, without evidence of lung disease, are of no significance except as a possible evidence of some healed inflammatory condition, possibly but not necessarily tuberculous. They are a common finding in normal chests.

Density and Thickness of Trunk Shadows. In the normal lung the bronchial trunk shadows are not visible in the extreme apical regions. For convenience of description the remainder of the lung is divided into three vertical zones, extending outward from the lateral border of the spinal shadow to the lateral chest border.

The inner zone contains the root shadows.

The mid-zone contains the trunk shadows, gradually fading out into their final subdivisions.

The peripheral zone contains radiating lines from these, fading off before the periphery is reached.

Where in the mid-zone or peripheral zone these shadows do not disappear in the characteristic fashion described, the appearance may be evidence of a variety of conditions, past or present, of an inflammatory nature or otherwise. It may accompany a tuberculous process, but is not necessarily indicative of tuberculosis.

Improper or Misleading Terms. The use of the terms "peribronchial tuberculosis" and "parenchyma tuberculosis" is not to be recommended in the interpretation of roentgenograms of the chest. Until corroborated by laboratory or clinical findings, the use of the terms "active" and "quiescent" should not be definitely applied to evident lesions demonstrated on plates.

(Signed)—Henry K. Pancoast
Kennon Dunham
F. H. Baetjer

May 6, 1922.

The X-Ray Analysis of the Sounds of Speech

A. E. BARCLAY, O B E., M. D. and WILLIAM NELSON, O. B. E.
Manchester, England

DURING the war there were a large number of cases of functional aphonia and the re-education in speech of these men presented very considerable difficulty. In the schools for the deaf and dumb charts were in use showing the various positions of the tongue and lips for the formation of the various sounds of speech, but these were not satisfactory as they were based, except in the case of the open sounds, on the personal impressions of the phonetician and others who made the charts. There was obviously room for considerable error, especially in the closed sounds. With a view to helping in this matter it was decided to attempt radiographic work upon the subject, as a result of which a number of experiments were made in order to show up the tongue, palate and pharynx. After a number of experiments it was found that the best method was to make a paste of bismuth carbonate with vaseline, and apply in a line down the middle of the tongue and frenum, with a corresponding line on the soft palate. As a further assistance a fine bismuth powder was insufflated on to the back of the tongue and into the pharynx. After a number of experiments we obtained satisfactory outlines and two subjects, teachers from the Royal Schools for the Deaf and Dumb, Old Trafford, were examined and three sets of records were made, the subject being instructed by one of us while the other was responsible for the radiography.

A series of eighteen plates was taken in each case and these had to be exposed very rapidly, as the bismuth did not adhere at all satisfactorily and any swallowing displaced it. The whole of the exposures, therefore, were made in a few minutes. A supply of intensifying screen sufficient for the purpose was not available so that the exposures were made on ordinary plates and no special apparatus was employed. A filter was placed against the subject's skin, and another filter of aluminum in front of the tube, and no ill results were recorded from the exposures.

The plates were carefully outlined on the viewing box and each set of three carefully compared; it was found that there was practically no difference in all the three sets of records. The best plate from each of the series was taken and outlined very carefully in ink, and the set obtained in this way was placed in the hands of the artist of the deaf and dumb school, Mr. Owen, who very kindly drew diagrams directly from the plates and at the same time drew sketches of the front view of the face for the various sounds.

We hoped to obtain a series of plates with the assistance of intensifying screens, which would be suitable for reproduction, but owing to various difficulties we have not done so and the work has been put aside for some years, together with the descriptions which were written out at that time. These we proposed to publish, but unfortunately the whole of the papers relating to the subject were stolen by some person, who probably scattered them abroad when he found out the valueless nature of his haul.

Professor Stopford and others, who saw the work, were anxious that the diagrams should be put in use, and they have not until now been published for the above reason, but we hope that we shall be able to take up the work again and expand it in various directions.

Legends for Illustrations

Fig. 1—"ar" as in farm—The lower jaw shows a considerable drop. The tongue lies on the floor of the mouth. The soft palate is in line with the hard palate. The resonance chamber is not in any way restricted. It is open and free and allows of the emission of a deep sonorous and powerful

sound. The opening at the lips corresponds.

Fig. 2—"aw" as in paw—The lower jaw shows a lesser drop than in "ar" but is still considerable. The tongue is drawn back and shows an almost regular arch from tip to root. At its highest point it almost touches the soft palate, which has slightly dropped towards it. The dotted line indicates a hollowing of the upper surface of the tongue from the tip to just behind the highest part of the arch. The lines of the upper and lower teeth are almost parallel and explain the effect of a slight raising of the lower jaw from the position of "ar." The resonance chamber is more forwarded and restricted in capacity than in "ar." The opening at the lips is round. The cheeks are slightly drawn in and the corners of the lips contracted.

Fig. 3—"oo" as in tooth—A still further modification of the drop of the lower jaw has taken place, bringing the teeth still nearer to a parallel position. The tip of the tongue is drawn back as well as the root, showing an almost perfect arch, which fits exactly at the sides to the line shown by the soft palate, but leaves in the middle a hollowed tongue passage for the current of air. The capacity of the resonance chamber is almost equal to that of "aw" but less wedge shaped owing to the blunted forward position of the tongue. The lip opening is small and round, showing greater contraction of the lips than in "aw" and still further protrusion.

Fig. 4—"er" as in fern—The drop of the lower jaw is almost identical with that in "aw" but the tongue rises more directly at the root and assumes an even flatter position on its upper surface than in "ar". To attain this position it is held away from the floor of the mouth somewhat. The hollowing at the middle of the tongue lies along the whole of its upper surface. The corners of the lips are very slightly drawn back.

Fig. 5—"ee" as in teeth—The drop of the lower jaw is less than in any other of the vowel sounds. The teeth are seen to be in parallel lines, almost but not quite meeting. The upper surface of the tongue and whole of the roof of the mouth form a narrow parallel air passage. The tongue shows no hollowing. The lips are well drawn back at the corners producing a narrow slit at the opening in correspondence with the form of the air passage.

Fig 6—"p" as in path, vocal counterpart "b" as in bath—The lips are slightly compressed. The air passage between the tongue and roof of the mouth is free throughout its length. The stopped breath produces the explosion on the instantaneous opening of the lips.

Fig. 7—"t" as in troop, vocal counterpart "d" as in droop—The lips are open. The tip of the tongue forms the stoppage at a point on the gums of the upper teeth. The release of the stoppage produces the explosion.

Fig. 8—"k" as in kick, vocal counterpart "g" as in gig—The lips are open. The stoppage is formed by the arching back of the root of the tongue, which shows no hollowing, to meet the soft palate. On the release of the stoppage the explosion is affected by the resonance chamber before it reaches the lips.

Fig. 9—"f" as in ferry, vocal counterpart "v" as in very—The upper lip is free. The upper middle front teeth are in gentle contact with the lower lip. The air passage is quite free and the breath is forced between the gently resisting lower lip of the upper front teeth.

Fig 10—"th" as in thin, vocal counterpart "th" as in thine—The position of the tongue is practically the same as in "t" but the tongue is hollowed and the current of air is forced between the gently resisting tip of the tongue and the upper front teeth.

Fig. 11—"l" as in land—The air passage is closed at the front by the pressure of the tip of the tongue against the upper front gums. The tongue is hollowed. The breath passes between the edges of the sides of the tongue and the cheeks.

Fig. 12—"r" as in round—The air passage at the back is slightly restricted by the dropping of the soft palate towards the sloped root of the tongue. It finds its outlet between the gently resisting tip of the tongue and the upper front gums. The sides of the tongue close up the passage used in "l." The tongue is slightly hollowed.

Fig. 13—"s" as in sand, vocal counterpart "z" as in zone—The lower jaw is slightly dropped. The tongue lies fairly flat but shows a distinct hollowing from the root almost to the tip where it is brought into gentle contact with gums of the upper teeth. The breath passage is free and hollow until the point of cheek is reached at the tip of the tongue. The lips are free.

Fig. 14—"sh" as in short—The photograph of this sound is extremely interesting. The soft palate and hollowed root of the tongue form a large funnel shaped passage for the start of the current of air. The outlet of the funnel is immediately below the junction of the hard and soft palates. Then the front part of the tongue is flattened,

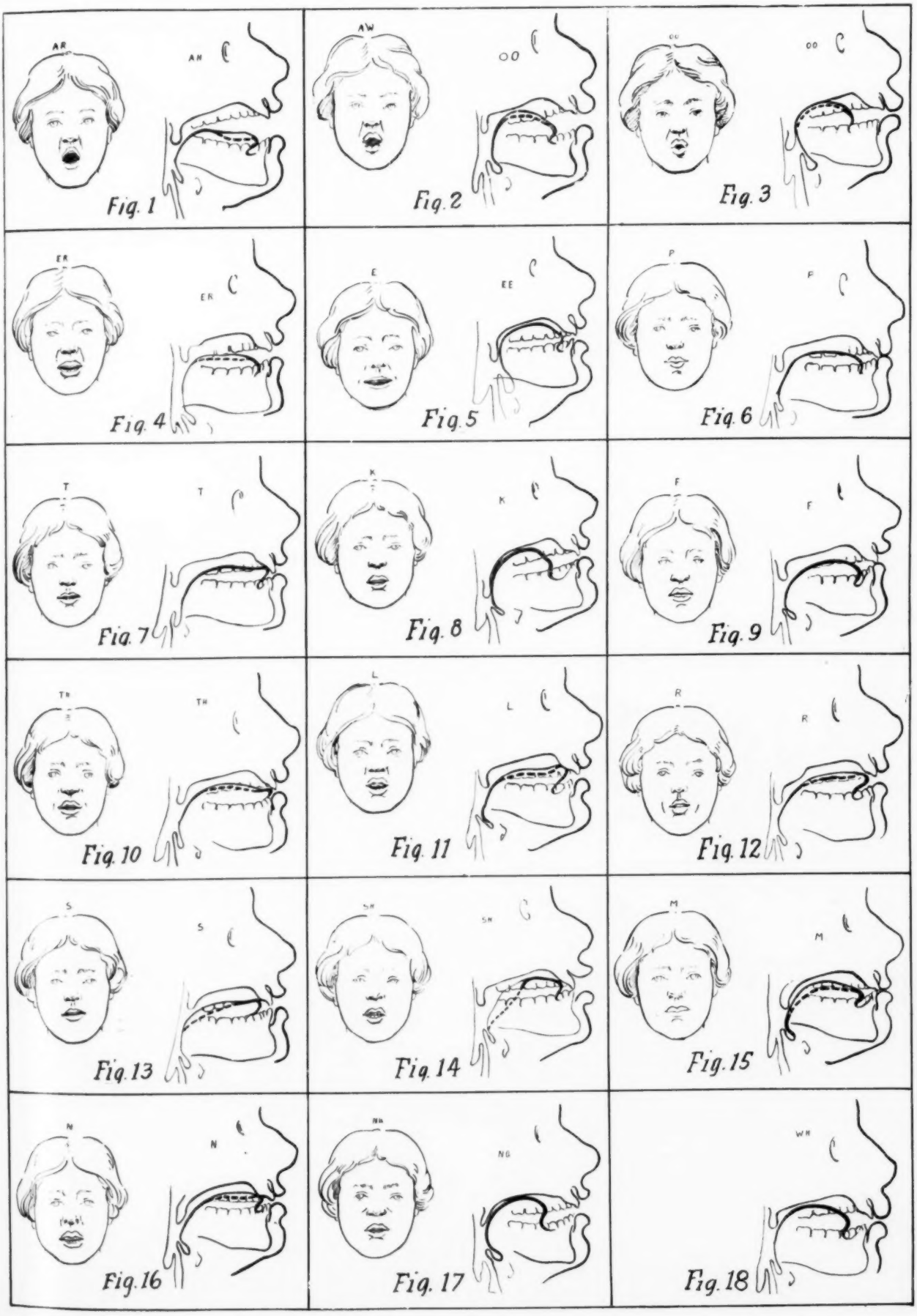
AR
AH
Fig. 1
AW
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Fig. 2
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Fig. 3
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Fig. 4
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Fig. 12
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Fig. 13
SH
SH
Fig. 14
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M
Fig. 15
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N
Fig. 16
NG
NG
Fig. 17
WH
Fig. 18

spreading the breath out through a wide shallow passage, and, as it were, intensifying its force for friction against the gums and teeth and over the wide tip of the tongue.

Fig. 15—"m" as in mine—The air passage through the mouth is closed at the lips. It finds its vent through the nasal passage. The resonance chamber is formed by the hollowing of the tongue and the roof of the mouth, mainly under the hard palate, but the resonant vibration can be felt at the nose.

Fig 16—"n" as in nine—The air passage is closed by the contact of the tongue all round the upper gums. It finds its vent through the nasal passage. The resonance chamber is further back than in "m", stopping at the teeth and not affecting the lips. The resonant vibration can be felt at the nose.

Fig. 17—"ng" as in song—Compare this position with "k", with which it is almost but not quite identical. The front and tip of the tongue is much rounded up and the curve of its upper surface shows a truer arch. The resonant chamber is back and nasal. The stoppage occurs at the middle of the soft palate. The resonant vibration is distinctly felt at the nose.

Fig. 18—"wh" as in what—Compare this sound with "oo". The tongue is not hollowed as in "oo". The air passage is between a flattened tongue and straightened palate. The tongue curves less abruptly at the root and is more forward at the tip than "oo". The pursing at lips is identical with "oo".

EDITORIAL

The JOURNAL OF RADIOLOGY

A Journal of ideas and ideals.

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Signs of the Times

IN the Journal-Lancet, June issue, appears "A Symposium on the Medical Profession and Its Relation to the Press and Public." That symposium is composed of a thesis on the medical phase of the situation by a practicing physician, a second by one of the editors of The Minneapolis Journal on the obligation of the press as a quasi-public servant to give the people medical facts and news because of their social importance, and a third by a minister of the gospel on the moral duty of both the medical profession and the press to teach and preach the science of correct living.

Discussion of these papers, which were read at a meeting of the Hennepin County Medical Society, includes comments by newspaper men, lawyers, and others.

Though it is not definitely so stated, the conclusion is inevitable that the purpose of the meeting in question was to afford the medical profession in that community intimate contact with the views and opinions of at least a part of the public on the various phases of the medical problem. Obviously, this was done in the belief that it might prove the beginning of some plan which would more nearly discharge the social obligation of the medical profession as the guardian of the life and health of the public—a question very prominent in medical minds everywhere at the moment.

Such an effort is certainly commendable. The only regret possible is that none of the principal speakers or discussants offered any concrete suggestion beyond the proposition that there is great need for, and the door is wide open to, proper publicity concerning the achievements of the medical profession. Apparently no thought was given to the larger questions this sort of an undertaking involves. Either no one present grasped the idea that it is necessary to predicate an effective educational campaign of publicity on the broad fundamentals supporting the whole scientific structure in its application to medical science, or if he did recognize what should be an obvious fact, he did not go behind the scenes deeply enough to convey the impression that he had given serious thought to its complicated factors.

In all fairness, however, it should be noted that Mr. Chamberlain, of The Minneapolis Journal, rather vaguely hinted that it is not possible to accomplish a more universal understanding of the medical profession's job until the profession itself, organizationally and individually, recognizes the social aspects of scientific research, and the right of the public to quick access to the findings and achievements of scientific workers. Perhaps he may be pardoned for not coming out plump with a statement that the medical profession is itself responsible for the condition which it apparently seeks to cure.

There is, of course, no question about either the power or the value of the right kind of publicity through the columns of the daily press in mattters pertaining to the scientific or medical side of the public health. That the newspapers are waiting with open arms for authentic scientific data written in understandable English, is proof positive that opportunity exists whereby the medical profession can, if it will, project itself into individual, community, and national life with sufficient force to accomplish whatever it earnestly desires so long as it shows proper forethought and respect for the public welfare. But it must be borne in mind that effective and intelligent publicity in the interest of the public health presupposes a large constructive purpose upon which to build public good will.

It is not purposed to raise any issue concerning either the ideals or attainments of the medical profession. They are traditional and conceded to be of the highest sort. But it can hardly be denied by any person who takes the trouble to follow current medical literature that there is a prevailing spirit of uncertainty about the future of medical science, particularly viewed in the preventive or social aspect, with very little corresponding effort to come at a comprehensive understanding of the ticklish problems involved. Yet this is the only way in which the medical profession can ever hope to achieve that condition of public confidence and respect for which it is obviously groping.

The point of this observation is that the public itself does not seriously entertain the notion that socialized medicine as it is commonly contemplated, will achieve the end sought. Rather, the best which can be said of it is that socialized medicine is the power invoked by the public to compel the medical profession to find itself and assume the responsibilities which rightfully belong to its sphere of activities as a factor in the social organism.

These are facts it is not easy to refute. Having examined them long and thoughtfully, these are the facts which drove the Journal of Radiology to the conclusion months ago that if the medical profession really and conscientiously desired to discharge its full duty to the public, both as individuals and as a social unit, it would be obliged to conceive and put into practice some constructive policy broad enough in its scope to include all humanity, and grounded deeply enough in those absolute fundamentals of every day human existence to command the respect of all thinking men at least.

Such an abstraction, it must be realized, is utterly valueless as a social proposition unless it is carried across into concrete application. It may be trite, but it is worthy of repetition, that without practical application, neither the medical profession nor the public can ever receive any tangible benefit from ideals, no matter how graciously acknowledged to hold the possible solution of the social dilemma.

At first thought, all this may seem far removed from the question of publicity—the thing specifically under discussion. But since the only kind of publicity that can be considered seriously, or tolerated at all in such a vital subject, must always be educative in character, the point made

is well founded; in fact, is indisputable. And no man will accept the responsibility of putting such an idea into function until certain assurances are given that professional machinery has been set in motion for the purpose of providing accurate scientific facts. It has been said no honorable man will accept this responsibility. The advertising scalawag and publicity hypochondriac, with neither conscience nor scruples, have no place in this desideratum.

Perhaps it will clarify what may otherwise appear an ambiguous statement, to say that theories espoused by any one man (no matter how amply proven to his personal satisfaction in a field of observation whose limitations are prescribed by human possibilities and the requirements of professional activity) are not, and can never be, sufficiently absolute and inclusive to encompass the whole problem of the public life and health. There are essentially many factors to which one mind cannot give detailed consideration. Each of these factors must be measured in its relation to all the others, and not as the sole conundrum whose solution will unleash the *deus ex machina* and guarantee the perfect superman, mentally, physically and morally.

Suiting acts to beliefs, during the past year the Journal has carried a series of editorial discussions expounding the purposes of a research program instituted by The Radiological Society of North America. Suggestions have been, and are constantly being, solicited from the faculties of all the higher institutions of learning, medical practitioners, and scientific and social workers.

While the survey in question has been specifically directed to the science of Radiology, yet it has elicited a method of procedure which can be applied with equal effect to the medical profession as a whole. That method of procedure is the co-ordination and correlation of all scientific research in all matters affecting the public health. It is contended that the medical profession should voluntarily assume the initiative in this important undertaking because it is *per se* responsible for the health of the nation as well as the individual.

Consequently, it is with a good deal of satisfaction that here and there appears proof of the fact that the idea is taking root. For instance, The Social Hygiene Bulletin for June, 1922, contains an announcement that the "National Research Council Sponsors Fundamental Research in Sex Problems." The opening paragraph reads:

> "The need for scientific research in the field of sex has long been recognized by scientific workers, physicians, and educators. With the cooperation of the American Social Hygiene Association and the Bureau of Social Hygiene, Earl F. Zinn was delegated to investigate the possibilities of a research program in this field. The matter was placed before the National Research Council, with the result that the program has been taken over by the Council."
>
> A committee has been appointed, whose purposes "are to determine the status of scientific knowledge in this field; to determine what research is now in progress in this and other countries; to secure from scientific workers, physicians, and educators, statements of the major problems on which more data are needed; and to make a thorough survey of research facilities, including trained workers who are interested in some phase or phases of this topic.
>
> "It is the committee's plan to aid scientific workers in their investigation in this field. An appropriation of $25,000 has been secured to carry on this work after July 1st, 1922. With this money the committee will subsidize as many researches as possible.
>
> "Concerning the nature of the research, the committee emphasizes the fact that it is interested in fundamental scientific studies and is endeavoring to lay the foundation for a prolonged scientific inquiry. When sound physiological bases are established, the work will be extended to include human problems.
>
> "Eventually this work will include the relationships of the subject to the following sciences: general biology, physiology, psychology, psychopathology, anthropology, ethnology, sociology."

It is also a privilege to quote excerpts from two letters just received. The first is from Abraham Myerson, M. D., Assistant Professor of Neurology at Tufts Medical School, Boston:

> "Thank you very much for sending me your magazine and the outline of your projected researches. I must confess that I am lost in admiration at your plans and the spirit and energy with which they are to be prosecuted. It is refreshing to see at least one branch of medicine that is utilizing all its resources and all the resources of the allied sciences in the effort to dis cover phenomena that will be of benefit to mankind. Your branch of the sphere of medicine is so rich in its possibilities as well as in accomplishment that those of us who deal with less concrete matter are a bit envious of you. I confess that such a spirit is still lacking in neurology and psychiatry."

The second is from Dr. C. H. Rieber, Professor of Philosophy at the University of California:

> "It has been on my mind for some time to tell you how much I enjoyed and appreciated an editorial in The Journal of Radiology for February on social medicine. It is a little masterpiece in logic—your argument is irrefutable."

Numerous others of similar vein might be quoted. But it is believed these are sufficient to indicate that the plan proposed appears both practical and feasible to men with vastly different modes of thought, located at points so far removed from the editorial sanctum of the Journal as to be uninfluenced by that sphere of peculiar personal suasion reported to be indigenous to the community in which an editor lives.

The members of the Radiological Society will find in these visible mutations of medical opinion whatever of mental stimuli they may need for the aggressive continuation of the work they have so nobly begun.

Radiology, as a diagnostic and therapeutic aid in the practice of medicine, holds so many latent possibilities and has already attained such eminence by actual accomplishment, that no opportunity should be lost to establish that science on a secure scientific footing.

In this connection publicity should be looked upon as the effect and not the cause. When viewed in that light if the profession's efforts and attainments are welded together by the co-ordination and correlation of all scientific endeavor, proper publicity will follow with certainty and precision and in turn become the medium through which a cohesive spirit of confidence in the profession will be achieved and a thorough appreciation of its value established beyond dispute.

The Industrial Physician

READING the following statement made by The New York Conference Board of Physicians in Industry as supplemented by the National Conference Board, the thought

occurs whether it is not a fact that much of the knowledge and special skill indicated as peculiarly necessary for the industrial physician and surgeon is also highly important for the physician or surgeon in general practice.

The New York Conference Board said:

"The physician in industry is one who applies the principles of modern medicine and surgery to the industrial worker, sick or well, supplementing the remedial agencies of medicine by the sound application of hygiene, sanitation and accident prevention, and who, in addition, has an adequate and co-operative appreciation of the social, economic and administrative problems and responsibilities of industry in its relation to society."

And the National Conference Board added:

"It was felt that in order to avoid a complicated statement it would be better to include in a definition only the broad fundamental principles upon which the work of the physician in industry is based, leaving to subsequent elaboration the finer details. It was pointed out that the definition adopted should emphasize both the medical attainments and the industrial requirements of the physician engaged in this work in order to make his duties clear both to the medical profession and to industrial management.

"It is assumed that the physician engaged in industrial work is well grounded in the fundamentals of medicine and surgery. He is, first of all, a physician. It is obvious, however, that this alone, while equipping him for satisfactory service in private practice, does not meet fully the requirements of industrial work. In his industrial experience he has of necessity to deal with questions of sanitation, hygiene and accident prevention as applied to large numbers of people working in comparatively close association.

"Only by special knowledge of the work in hand will the physician be able satisfactorily to discharge his duties. His knowledge of plant processes together with the physical examination of applicants for employment and of workers already engaged will enable him by judicious placement to reduce materially the accident and morbidity hazard and rate.

"It must be realized that many of the qualifications for successful medical work in industry are of a non-medical nature, and call for a knowledge of the laws of social and industrial economics and of the administrative problems which arise in the conduct of an industrial medical department. The physician in industry must have a clear conception of the responsibilities of the industry to its workers and through them collectively to the community. On the other hand, he should recognize clearly the duties of workers to the industry in which they are engaged.

"It is hoped that this definition will tend to remove misconceptions as to the work of the physician in industry and establish his position and his work upon a basis satisfactory alike to the physician and to the industrial organization."

Surely the general physician or surgeon, coming in contact with patients engaged in all lines of endeavor instead of one particular industrial occupation, has greater need for precise knowledge with respect to social requirements than has the so-called industrial physician.

This is especially true because the general practitioner is in a very real sense a disinterested adviser, and carries a greater responsibility to the community, state and nation by reason of that fact.

This thought is not interjected for the purpose of impugning the motives of the industrial physician. In the inherent nature of the case, however, the industrial physician is influenced to some extent by the fact that he is essentially a protagonist of the industry or concern he represents and by the degree of that influence no matter how unwitting it is, his social conception of medicine fluctuates.

This is demonstrated by the fact that the National Council expresses the opinion that while medical training is sufficient for the general practitioner it is far from sufficient for the industrial physician. Viewed in the sense of social duty it is somewhat difficult to thus differentiate between the obligation of two physicians simply because one collects his stipend from the public directly and the other indirectly.

For these and other reasons it would seem that the National Conference Board has taken a far-reaching step toward impressing on the whole profession a definite notion of the social side of medical practice.

The Apparatus Problem

ONE of the immensely practical benefits which will accrue to practitioners of radiology, the result of such a research program as that undertak by the Radiological Society, will be a better knowled of methods used by individual manufacturers of apparatus for the application of radiant energy in its various forms.

Several of the large manufacturers of apparatus have already requested that the Radiological Society appoint an examining board, composed of one or more thoroughly reputable and disinterested physicists, to whom they can submit complete data concerning every piece of apparatus they now, or may hereafter, have on the market. The name of Dr. William Duane of Harvard has been suggested as indicating the caliber of man the manufacturers have in mind.

It goes without saying that the members of the Research Committee—and in this respect they believe they voice the best interests of radiologists everywhere, whether members of the Radiological Society, of some other similar organization, or of none at all—appreciate the community of spirit evidenced by those manufacturers seeking the establishment of this sort of disinterested scientific control over the commercial or mechanical side of the question.

Such an arrangement will do no harm to the honorable manufacturer—indeed, it will be a potent aid in stabilizing the future of the science—for it will rid the field of wilful misrepresentation, and enthusiastic but certain ignorance, and will assure the person conscientiously trying to discover further phenomena the opportunity to present his findings for review before a sympathetic, intelligent and unimpeachable board.

The value of all this to the individual radiologist is apparent. Such an arrangement will overcome the confusion existing in the minds of radiologists generally with respect to representations made by manufacturers—in short, it will put every radiologist sufficiently interested in the subject to follow the proceedings and findings of the board, in position to buy intelligently the apparatus and equipment best suited to his particular needs and practice, without spending weeks away from home viewing other installations at a heavy financial expense in loss of practice, railroad fare, hotel bills and the like.

Thank You

THE following is an excerpt from an editorial appearing in the May issue of Colorado Medicine: "The Radiological Society of North America, an organization which has advanced with rapid strides in the last four years, is

launching a somewhat colossal undertaking in the way of research work in radiology. The continued discoveries of new uses for the x-ray and new methods of application, as well as new and more powerful apparatus, are the result of research work carried on largely for the love of it by individuals, many of whom have gained outstanding fame in the field of radiology. These efforts have been necessarily more or less spasmodic, the character of the work undertaken by different individuals has depended on their interest in some particular phase, and there has been little attempt at co-ordination of effort. The undertaking now in hand is to raise a large 'research endowment fund' for systematic initiation and supervision of research work in radiology. The plan does not contemplate the establishment of one large research laboratory in a large center, but is to provide for carrying on work through channels already in existence, among which are x-ray laboratories of most of the large universities and many privately owned ones. Harvard, Wisconsin, Illinois, Michigan, Iowa, Loyola, Cincinnati, Leland Stanford, Kansas, California, Washington, Rush, and many others have already signified their willingness to co-operate. Much of the money is to be raised by subscriptions of radiologists who are members of the society before any attempt is made to enlist outside support. This would seem to evidence the sincerity and enthusiasm of the members who are backing the plan."

Features of the St. Louis Meeting

THE attendance at the St. Louis meeting was larger than is usual at the summer meetings.

It is highly fitting that public acknowledgment be made of the excellent service rendered by the local committee on arrangements, of which Dr. Edwin C. Ernst was chairman. No detail was left unarranged. The committee deserves the highest commendation for the service rendered.

On the scientific program the greatest tribute was paid to Maude E. Slye, Ph. D., when she read her paper entitled, "The Inheritability of Spontaneous Cancer in Mice and its Application to Man." This paper represented eighteen years of research work. The material was so ably presented and so abundantly proven that no one can disprove the facts laid down. The audience was so impressed with the value of this material that the applause following its presentation was long and enthusiastic, and when the author failed to acknowledge this ovation the audience arose to its feet as a further expression of appreciation.

The paper presented by Dr. Leo Loeb of Washington University, St. Louis, on "Cancer from the Standpoint of Etiology and Pathology," was very helpful and very important to radiologists.

The paper given by A. C. Ivy, Ph. D., on "Studies on the Effect of X-rays on Glandular Activity," was one of very great importance to those practicing x-ray therapy. It is certainly to be hoped the doctor will go on with this work and present further material along this line at a later meeting.

The paper of Dr. George E. Pfahler on "Radiotherapy of Carcinoma of the Larynx with Special Reference to Needling Through the Thyroid Membrane," was a timely one, and showed the careful work which this man does in the treatment of malignancy.

Considerable discussion was provoked by the paper entitled "The Effects of Heavy Radiation on the Pleura and Lungs," given by Dr. Tyler. This is a subject of extreme importance to those using the x-ray in therapy. The results of further investigation along this line will be presented at a later meeting.

The banquet on Saturday evening was informal and elicited many complimentary comments.

The commercial exhibit was unusually interesting, was well arranged and many expressions of satisfaction were tendered by the commercial men.

John F. Shearer, Ph. D.

OSLER once said that pneumonia was the old man's friend. His demise proved the truth of his statement. Although pneumonia, followed by heart complications, caused the death of our beloved brother and co-worker, John F. Shearer, the adage hardly applies in his case, for he was just in the prime of life—his work only half done.

It will be recalled that Professor Shearer was very active in the American Roentgen Ray Society. In fact, he served as chairman of the Committee on Safety. Although the report of this committee is as yet unpublished, it was completed shortly prior to his death and will remain as a tribute to his untiring industry and far sighted scientific ability.

JOHN F. SHEARER

When physicists were needed for military service in the recent war, Professor Shearer volunteered and was made Chief Technical Consultant to the X-ray Division, American Expeditionary Forces. His services in France were of untold value to the American army.

His position as Professor of Physics at Cornell University gave him an opportunity to carry out much research work in the field of x-rays. His last work was the perfection of a bedside unit, which is proving highly satisfactory. He co-operated with Dr. W. D. Coolidge in perfecting the portable army unit, which proved so valuable in the recent war and which was responsible for the statement made by many that the X-ray Division of the American Expeditionary Forces was the best equipped of any force in the field.

May 16, 1922, closed the physical life of Professor Shearer. But he will long live through the results of his achievements and render service to science and humanity.

Scientific Progress

TWO very important features appear in this issue of the Journal:

1. The X-ray Analysis of the Sounds of Speech by A. E. Barclay, O. B. C., M. D., and William Nelson, O. B. E., of Manchester, England. This is in the nature of a preliminary report of a very interesting study, hitherto unpublished.

2. Preliminary Report of Joint Committee of Clinicians and Radiologists appointed by the Medical Research Committee of The National Tuberculosis Association to investigate normal chests of children from six to ten years of age. This committee is composed of H. K. Pancoast, M. D., and H. R. M. Landis, M. D., of the University of Pennsylvania; F. H. Baetjer, M. D., and C. R. Austrian, M. D., of Johns Hopkins University; and H. K. Dunham, M. D., and K. D. Blackfan, M. D., of the University of Cincinnati.

The Journal feels very greatly honored in being accorded the privilege of publishing contributions to scientific progress by such eminent men.

The New England Roentgen Ray Society

THE New England Roentgen Ray Society at a meeting held at the Harvard Club, Boston, on June 2nd, elected the following officers for the years 1922 and 1923: President, Arial W. George, M. D., Boston; Vice President, Ernest L. Davis, M. D., Springfield; Secretary-Treasurer, Adelbert S. Merrill, M. D., Boston; Executive Committee, Alexander S. McMillan, M. D., Boston, chairman; Isaac Gerber, M. D., Providence; Arthur Heublein, M. D., Hartford.

American Registry of Radiological Technician

History

THE registry is the result of a long and careful study. It was found that there was a great need for the registration and control of radiological technicians. Due to the lack of encouragement by the radiologists, no organization for this class of technicians has received widespread support. The American Association of Radiological Technicians formed the nucleus for a larger and highly ethical body of workers. But too often the technician was left in isolation or thrown on his own resources, so that he became in a way a competitor and not a medical assistant. To raise the ideals of this class of medical technicians, to recognize the value or worth of their service, and in the end to prevent frauds and deceptions on the public, are the chief reasons for the establishment of this registry.

For two years a committee appointed by The Radiological Society of North America investigated the need of a Board to register technicians. From the British Medical Society, the Canadian Radiological Society, leading American Radiologists, prominent women in the nursing vocation, and worth while technicians, advice was sought and obtained. In the main, The Radiological Society of North America has been the chief sponsor of the movement. The American Roentgen Ray Society, through Dr. E. H. Skinner and others, has encouraged the movement. As a result, it is expected that the Board now created will form the basis for a permanent registry to encourage, to control the radiological technicians. As time goes on the different states and cities may pass laws establishing just the sort of thing we have now done, but in the meanwhile such action is largely in our hands and may be directed in wise channels.

The effect of the creating of such a registry has been and will be far reaching. Commercial houses manufacturing and selling x-ray equipment have replied endorsing the plan, and admit the principle of keeping ethical by working with radiologists instead of impostors. The Board of Health of New York City has already added to the Sanitary Code laws requiring technicians to register. They have advised with and recognized the representatives of the Society. It is their aim to issue permits only to medical radiologists.

The future work of the Committee on Relationship between Radiologists and Technicians will be to foster the registry, and to carry on a campaign in every state to bring about through the legislature effective sanitary codes. The medical practice acts must be so defined that it will be clearly set forth that the examination or treatment of patients for disease will mean the practice of medicine. All x-ray laboratories will be registered and under the supervision of a medical radiologist.

Personnel

President . . . . . Dr. Edward W. Rowe, Lincoln, Nebraska
Secretary . . . . . Dr. Byron C. Darling, New York City
Examiner . . . . . Mr. Ed C. Jerman, Chicago, Illinois
Executive Secretary . . . Mr. H. S. Tyler, Omaha, Nebraska

All communications should be addressed to Mr. H. S. Tyler, Omaha, Nebraska, Arthur Building.

At present Dr. E. H. Skinner of Kansas City represents unofficially The American Roentgen Society. It is hoped that his selection at their next annual meeting will be made permanent. A place is open to the Canadian Radiological Society. Dr. L. K. Poyntz has aided materially. Action for appointment to the Board is expected as this goes to print. Correspondence is now going on with the American Radium Society, offering the services of the Board for the registration of radium technicians. It is hoped also that a representative from the American Medical Association or the American College of Surgeons may be secured, to gain some recognition and guidance from those influential organizations.

Since the technicians are a necessary adjunct to our work, since they represent workers in a highly technical field, it is only right and proper that we should give them recognition and help. Our interests are mutual—appearance of competition must be removed, otherwise this good feeling can not exist.

Every radiologist is asked to inform himself thoroughly on the objects of the Board. Also, he is urged to see that his technicians at once avail themselves of this opportunity to obtain a certificate of registry from the Board, which will recognize and encourage only high grade technicians.

Edward W. Rowe, M. D.
President, Broad American Registry of Radiological Technicians.

Rules and Regulations

(Adopted and Approved by the Executive Committee)

ARTICLE I.

The Board

Section 1. A Board of SIX shall be appointed, each member to serve for three years. There shall be two members of The Radiological Society of North America, one member of The American Roentgen Ray Society, one member of The Canadian Radiological Society, one physician and surgeon recommended by The American Medical Association or American College of Physicians and Surgeons, and one representative of The American Association of Radiological Technicians.

Section 2. Duties of the Board. The Board shall pass on the acceptability of candidates seeking certification as to their ability to practice as assistants to any reputable physicians or surgeons; it shall arrange for the examination of acceptable candidates; it shall seek to effect the regula-

tion of all technicians not working under recognized medical supervision, by means of the adoption of proper State and City Sanitary Codes and amendments to the Medical Practice Acts of the States throughout the United States; it shall serve as a source of information as to training schools for x-ray technicians.

Section 3. The Board shall have two regular meetings a year, preferably at the time of the annual and semi-annual meetings of The Radiological Society of North America. At the Spring meeting one radiologist (or roentgenologist) shall be designated as Chairman to serve for one year; and one radiologist (or roentgenologist) shall be designated as Examiner to serve for one year.

Section 4. A salaried Executive Secretary shall be chosen by the Board to carry out the details of the work and act as business manager.

Section 5. These rules and regulations may be revised or amended by the Board at any regularly called meeting.

ARTICLE II.

Registration of Technicians

Technicians whose names are placed on the records of the Board shall be classed as "apprentice technicians" and "radiological technicians." The term "apprentice technician" shall apply to all those who have completed a probationary training period of three months. No certificate will be issued and no fee charged to this class of technicians. An apprentice technician and others who have met all the requirements and successfully passed the examination of the Board shall be designated as "radiological technicians."

ARTICLE III.

Certification of X-ray Technicians

Section 1. Qualification of candidates. Applicants shall be twenty-one years old, male or female. They shall have the equivalent of a two years' high school education and that of a trained nurse. They shall have served as x-ray technicians at least two years under direct medical supervision, counting their bona fide training period.

Definitions: "Equivalent of a two years' high school education"—a student from a private preparatory or other school covering two years of a high school curriculum; or others who have supplemented their knowledge by courses at evening school or by private tutorage of a like school grade.

"Trained nurse"—graduate of a recognized school.

"Equivalent of a trained nurse"—a technician, male or female, who has served at least two years under medical supervision.

Section 2. Application for examination. All applicants shall furnish the following information: Age, education, experience in detail, chronologically arranged; three medical men as references, preferably radiologists; physical description—height, weight, and photograph.

All applicants for examination shall agree to work at all times only under direct medical supervision and under no circumstances to give out written or oral diagnoses or work independently, whether in a private, hospital, or institutional laboratory.

Applications shall be filed with the Executive Secretary of the Board together with a fee of $10.

References shall be investigated by the Board to determine moral character, training, ability, and other qualifications of candidate.

Section 3. Examination. The Board shall designate some radiologist of recognized ability in the district nearest the applicant, to conduct the examination and report to the Board.

Candidates who have given evidence of satisfactory qualifications and have paid the fee of $10 shall be notified by the Board of the time and place of the examination.

The Examination shall consist of two parts: (a) practical demonstration of ability, (b) written examination. The questions and subjects covered shall be determined by a member of the Board designated as Examiner and submitted to the Chairman of the Board for approval.

The written examination shall cover (1) Anatomy; (2) Physics—theory; (3) Technique—x-ray room and dark room service.

The practical demonstration shall cover (1) Physics—practical demonstration of machinery; (2) Technique—demonstration by films of specified subjects, and developing.

Questions for the written examination and the subjects for the practical demonstration to be sent under seal to the radiologist appointed to conduct the examination.

Results of the examination, both written and practical, shall be sent to the Examiner for the Board under seal.

No limit is placed upon the number of times a candidate may apply for re-examination, except that re-application may not be made for three months after failure to pass an examination.

Section 4. Certificates. A certificate shall be issued to all candidates who have passed the examination with a grade of not less than sixty per cent. This certificate shall be good for one year only from date of issue; it shall be renewed upon the payment of $1.00 yearly.

A certificate may be revoked at any time for cause, at the discretion of the Board.

A technician whose certificate for sufficient reasons has been revoked may not be admitted to examination for a period of six months after receipt of re-application, during which time his or her conduct shall be subject to investigation by the Board.

ARTICLE IV.

Further Control of Technicians

This Board shall endeavor to secure the co-operation of State and City Health Officials to further regulate and control technicians by effecting changes in the sanitary codes and revision of medical practice acts throughout the United States to the extent that it shall be illegal for any technician to carry on x-ray work other than under direct medical or dental supervision. It shall further seek to secure the co-operation of National, State, and County Medical Societies.

ARTICLE V.

Registration of Training Schools

Any radiologist (or roentgenologist) who offers a course of training for x-ray technicians in his private office, or any school or institution where such courses are given, may be investigated by the Board. Upon receiving evidence of satisfactory standards, they shall be placed upon a list of such schools and radiologists (or roentgenologists) for distribution to those qualified and seeking information of the Board.

ARTICLE VI.

Reciprocation and Registration

If in the judgment of the Board, like standards of qualifications and examination of x-ray technicians prevail, this Board may recognize the registration of other radiological societies or associations and issue a certificate to an applicant on payment of the regular fee of $10 for certification and yearly re-registration fee of $1.00.

APPLICATION FOR REGISTRY

Date.....

Name in Full....., Age.....
(LAST NAME) (MIDDLE NAME) (FIRST NAME)

Address....., Height....., Weight.....

Education: General—High School.....

No. Years..... Date Graduated.....

Private School.....

No. Years..... Date Graduated.....

College.....

No. Years..... Degree.....

Special—Nursing; Institution.....

No. Years..... Registered.....

Electrical, Secretarial, or Other.....

.....

.....

Experience: Nursing.....

.....

.....

Secretarial or Other.....

.....

.....

X-ray experience in detail, chronologically arranged. (If this space is not sufficient, use separate sheet and attach.).....

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.....

.....

References—Three Medical Men, Preferably Radiologists—(Names and Addresses)

1—.....

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2—.....

.....

3—.....

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I, ..., hereby agree to work at *all times* under direct medical supervision, and under no circumstances to give out written or oral diagnoses or work independently, whether in any private, hospital or institutional laboratory.

(Signed)—.....

☞ N. B.—Print legibly or typewrite information when filling out this blank. Enclose a photograph taken within six months of application.

(OVER)

NOTICE TO APPLICANTS

(Please read carefully all information)

Technicians whose names are placed on the records of the Board shall be classed as "apprentice technicians" and "radiological technicians." The term "apprentice technician" shall apply to all those who have completed a probationary training period of three months and who wish to signify their desire of becoming registered with the Board when qualified. No certificate will be issued and no fee charged to this class of technician. An apprentice technician and others who have met all the requirements and successfully passed the examination of the Board shall be designated as "radiological technicians." For information regarding requirements for examination, etc., address the Executive Secretary of the Board.

An application for registration as "radiological technician" must be accompanied by a fee of $10 (check or money order, payable to the American Registry of Radiological Technicians).

Qualification of candidates for registration as Radiological Technicians. Applicants must be twenty-one years old or over; they must have the equivalent of a two years' high school education and that of a trained nurse. They must have served as x-ray technicians at least two years under direct medical supervision, counting their training period. (A technician who has at least two years' experience will be considered to have training equivalent to that of a trained nurse).

Candidates who have given evidence of satisfactory qualifications and have paid the fee of $10 will be notified by the Board of the time and place of the examination.

The examination will consist of two parts (a) practical demonstration of ability, (b) written examination. For further particulars apply to the Executive Secretary of the Board.

The written examination will cover (1) Anatomy; (2) Physics—theory; (3) Technique—x-ray room and dark room service.

The practical demonstration will cover (1) Physics—practical demonstration of machinery; (2) Technique—demonstration by films of specified subjects, and developing.

No limit is placed upon the number of times a candidate may apply for re-examination, except that re-application may not be made for three months after failure to pass examination.

A certificate will be issued to all candidates who have successfully passed the examination of the Board. This certificate shall be good for one year only from date of issue; it may be renewed upon the payment of $1.00 yearly.

A certificate may be revoked at any time for cause.

A technician whose certificate, for sufficient reasons, has been revoked may not be admitted to examination for a period of six months after receipt of re-application, during which time his or her conduct shall be subject to investigation by the Board.

The United States Army Manual is recommended as a text book covering the technical work, 1918 edition, Paul B. Hoeber, publisher, 67 East 59th St., New York City.

Address communications to

MR. H. S. TYLER, Executive Secretary,

American Registry of Radiological Technicians,

305 Arthur Bldg., Omaha, Nebraska.

Max Reichmann, M. D.

MAX REICHMANN was born in Prague, Austria, November 19, 1864. He was educated in the schools and University of Prague, graduating in 1892. At one time he was a student of and associated with Albert Schoenberg, whose memorial and biography he prepared and presented to the German Medical Society in the fall of 1921.

In 1895 he married Sophie Beck and they had two children, Olga and Margaret. The mother died in 1911 and later he was married a second time to Johanna Stein, who with his two children survive him.

In 1895 also he was licensed to practice medicine in Illinois. He was a member of the Chicago Medical Society, Illinois State Medical Society, the Berliner Roentgen Gesell, the Muenschener Roentgen Gesell, and the Prague Roentgen Gesell. He was a frequent contributor to the Muenschener medizinische Wochenschrift, the Berliner medizinische Wochenschrift, Fortschritte der Roentgenstrahlen and other German medical publications. He presented a paper upon Fuerstenau's Tiefenmesser before the Chicago Medical Society some years ago.

During his life in Chicago he took an active part in the affairs of the German organizations there, serving as president and secretary of the German Medical Society.

He was at one time roentgenologist to the Alexian Brothers and to the Augustana Hospitals. At the time of his demise he was roentgenologist to the Englewood Hospital of Chicago.

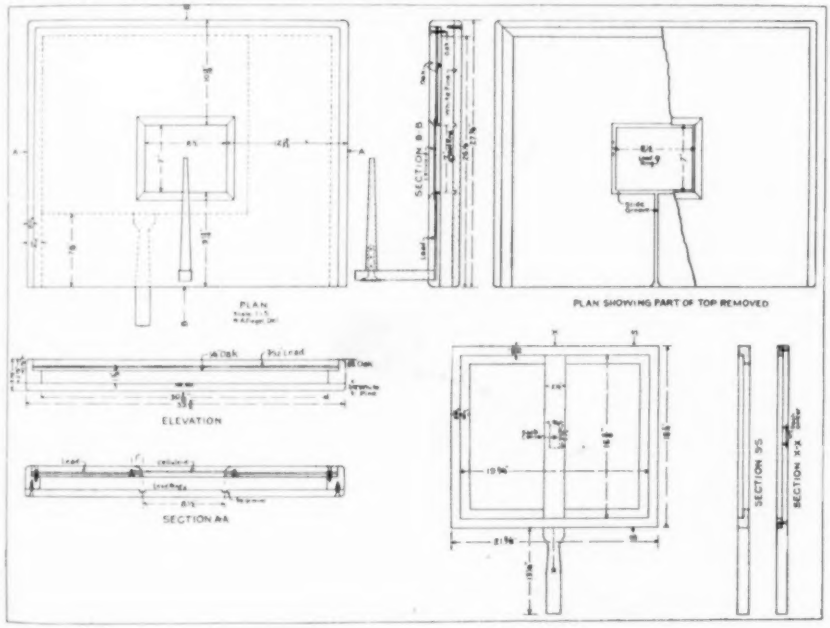
He died in the fifty-sixth year of his life of carcinoma of the rectum. To Dr. Reichmann belonged the distinction of being the first x-ray practitioner in the city of Chicago.

DEPARTMENT of TECHNIQUE

A Table Used for Making Serial Radiographs o the Pyloric Region of the Stomach

DALTON RICHARDSON, M. D.
Austin, Texas

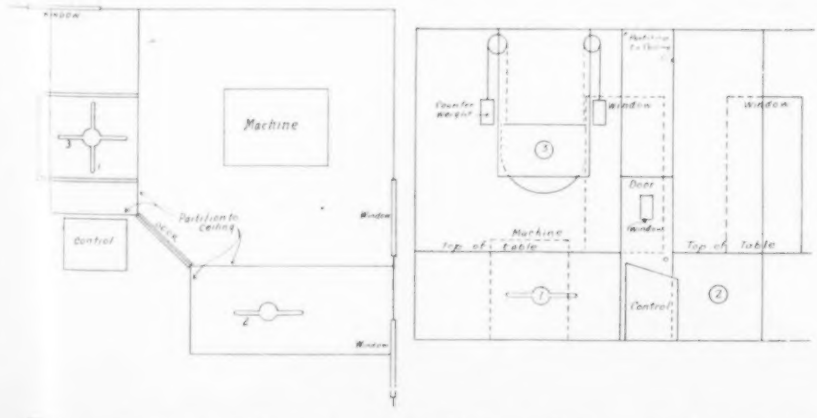
THE sketches herewith show the measurements for a table which I have devised for making four exposures of the pyloric region of the stomach on a single fourteen by seventeen plate or film. This device has the advantage of economy and convenience. The drawings, I think, are self-explanatory.



Another Deep Therapy Plan

BENJAMIN W. BAYLESS, M D
Louisville, Kentucky

THE accompanying diagram gives the arrangement of the deep therapy installation of Dr. Benjamin W. Bayless of Louisville, Kentucky.



This arrangement makes a very flexible unit, as two patients can be treated at a time from below or one patient from above and below and any part of the body can be treated. The patients are always in a comfortable position, as they are on the back or side. The tubes No. 1 and No. 2 are adjustable under the tables, and No. 3 is adjustable in the half cylinder which is also movable up and down so any focal distance desired is obtained. The tables are lead lined on the top, end, and side with diaphragms cut in the top of the tables over the tubes so the operator and patient are well protected. The table is open on the side next to the machine for placing the tube and making the connections. The half cylinder is lead lined with a diaphragm cut in the lower part below the tube and is counter weighted so is movable up and down and is open above and on the end next to the machine for the connections. The filters are placed in the diaphragms and various size diaphragms are made out of lead to slip in with the filters and used when necessary. The tubes No. 2 and No. 3 are on the same line and, of course, not operated at the same time. The partitions are carried to the ceiling so the machine is in a separate room. The door is lead lined with a window cut in it to observe the machine, meters and sphere gaps. It is not necessary to cover the patient with lead or leaded rubber, as the diaphragm is practically against the part of the body to be exposed and the rest of the body is protected by the lead lining of the tables and the half cylinder. The tables are made long and broad enough so the patient can be placed on the table and any part of the body exposed through the diaphragm. There is a window at the end of each table which makes the ventilation very good. Patients can shift the position of their legs, arms or head to relieve the strain, and if they touch anything there is no danger, as the tubes are placed well away from the tables and all the lead is grounded.

Dr. Bayless has been treating patients with tubes No. 1 and No. 3 at the same time and it shortens the stay of patients on the table one-half, as they get an exposure on the front as well as the back. He does not notice any difference on the patients except they can not take as long exposure with two tubes as they can with one. They are more apt to become nauseated in a shorter time, but there is no more reaction.

NEW EQUIPMENT

The Cameron Adjustable Self-Rectifying Radium Applicator

EVERY user of radium, particularly in those cases where the mouth, tongue, throat or face is involved, will appreciate the serviceability of the Cameron Adjustable Self-Retaining Radium Applicator now being sold by the Radium Chemical Company of Pittsburg.

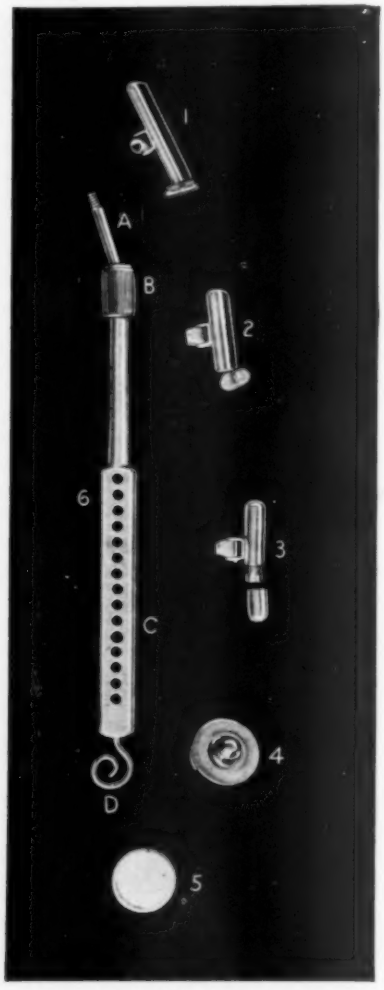


PLATE NO. 1

The value of this device lies in the fact that the radium can be held exactly in the place desired during the entire period of application. An applicator of this kind has been greatly needed ever since radium therapy began.

Nos. 1-2-3 Plate No. 1 —Radium containers and screens (adjustable to various angles) for holding (No. 1) 4 or 5 needles, (No. 2) two 25 milligram tubes, and (No. 3) one 50 milligram tube. These containers are fastened on end of No. 6 at "A" by screw-joint, and when in position may be locked.

No. 4 Plate No. 1 —Slip-on Holding Device (adjustable to various angles) for a specially devised plaque (see No. 5). This device is fastened on end of No. 6 at "A" by screw joint, and when in position may be locked.

No. 5 Plate No. 1 —Specially designed two and one-half strength, flat-surfaced, round, glazed plaque, containing 25 milligrams of radium element. Outside diameter 10 mm. This applicator may be utilized for superficial applications.

No. 6 Plate No. 1 —Adjustable handle for radium containers. This handle is so constructed that by turning "B" point "A" may be ad-

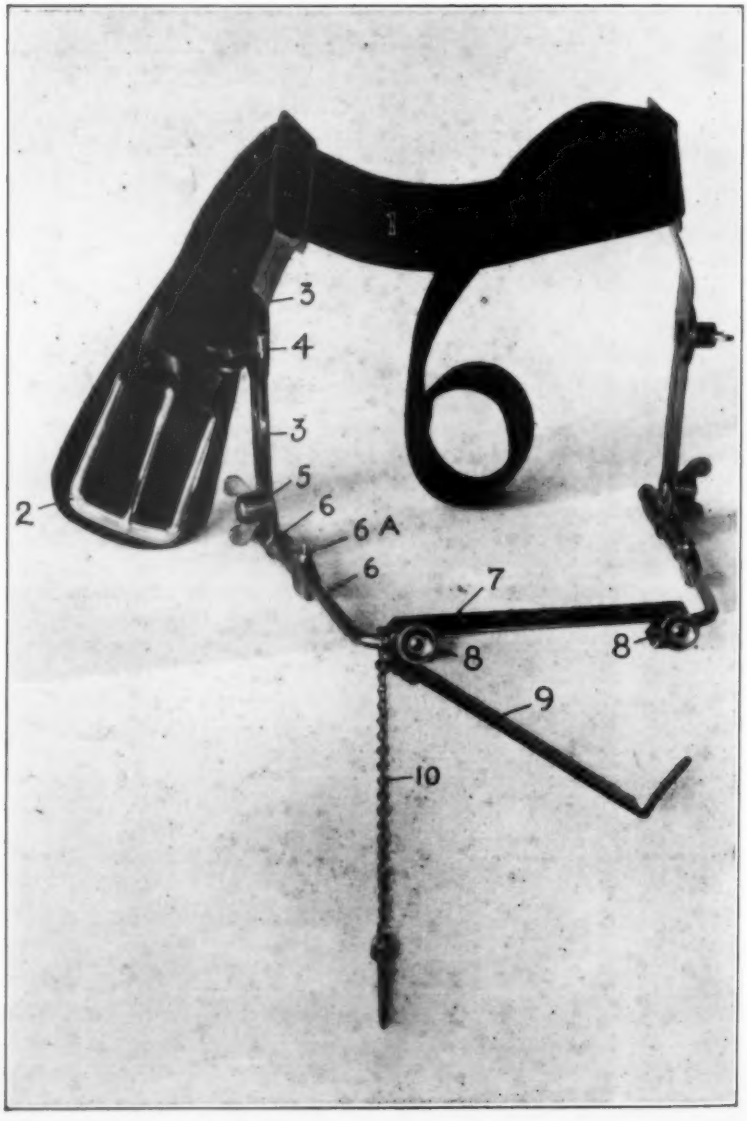


PLATE NO. 2 *Holding Device for Radium Containers and Handle*

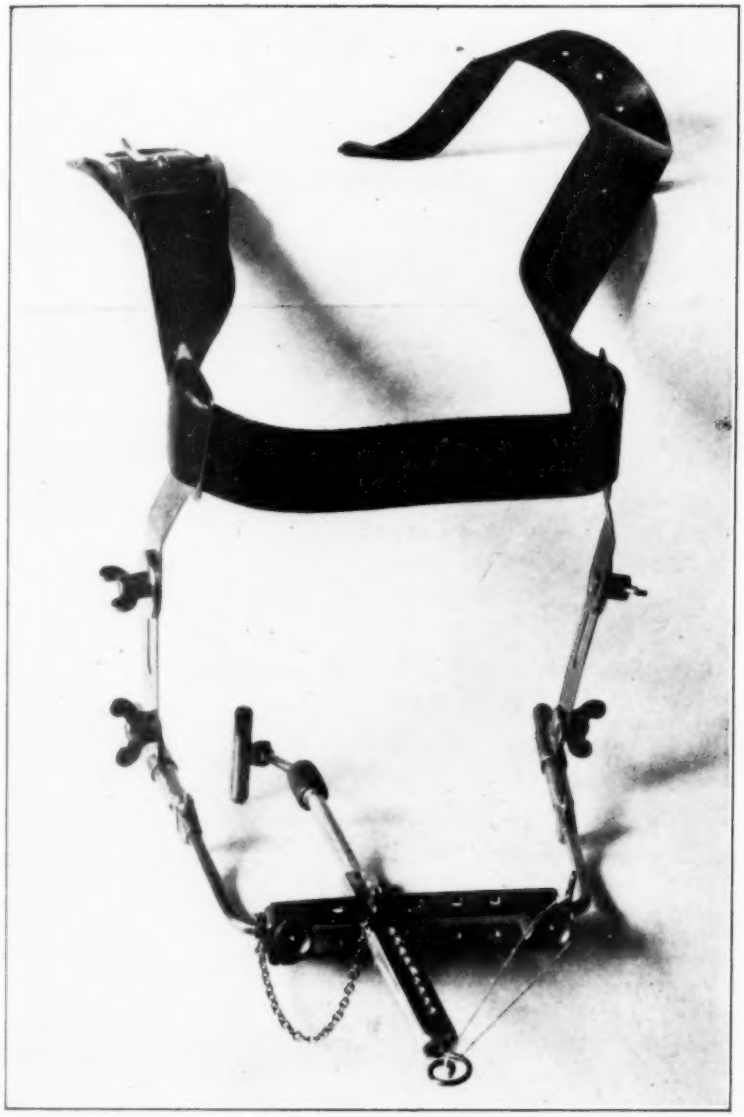


PLATE NO. 3 *Showing Device, Radium Container and Handle Assembled*

justed and locked at various angles. At "C" the handle is perforated so that it may be held (by pin) in mouth piece of holding apparatus. At "D" is an arrangement for attaching rubber band to make desired pressure of radium containers Nos. 1-2-3-4-5 against part being rayed (see Plate No. 3).

Showing at (1) soft leather headband and non-slip buckle (2). Adjustable cheek-plate at (3), adjustable by means of thumb screw (4) upward and downward, forward and backward. Connecting rods (6) adjustable forward and backwards by means of thumb screw at (5), and in and out by reason of joint at (6-a). Mouth piece (7) adjustable to any angle by means of ball and socket joint on (6) and fixed by thumb screws at (8). Upper plate (7) of mouth piece perforated to accommodate locking pin (10); pin also passing through perforations in handle of radium container (Plate No. 1). Lower plate of mouth piece (9) hinged so as to drop down while radium container is being introduced. After pin is placed this plate is locked in position, as shown in Plate No. 3.

Rubber band fastened on "D" of Plate No. 1 and either side of mouth piece to make pressure of radium container against part.

The brass end of handle ("A" and "B" of Plate No. 1) is covered with thin rubber tubing, or Doherty's Palate Rubber.

The Standard Iontoquantimeter

THE iontoquantimeter is an instrument designed for the measurement of relative intensities of x-rays. It consists essentially of an electroscope and an ionization chamber, conductively connected by means of a well insulated wire cable or rod.

THEORY

Gases under ordinary conditions are very poor conductors of electricity, and smooth bodies like metallic spheres may be charged to a considerable potential, and retain that charge for some time in such gases, for example, air.

If, however, various agents, such as radium, ultra violet light, or x-rays be directed through the gas surrounding the charged sphere, it is found that the charge disappears. This leakage of the charge can be due to only one cause—that the surrounding air has become a conductor. The process of causing air to become a conductor is called ionization, and resulting air is said to be ionized.

In terms of modern electrical theory, the process of ionization is as follows: An atom consists of a positively charged nucleus, containing practically all of the mass of the atom, surrounded by negatively charged electrons, which revolve around it, possibly in the manner of planets around the sun. In such an atom, the sum of the positive electrification of the nucleus is equal to the sum of the negative electrification of the electrons, and the result is an electrically neutral atom. A gas, then, is composed of such neutral atoms (sometimes combined with themselves to form molecules), and is practically non-conductive. When x-rays are passed through the gas, they "knock off" an electron from the neutral atom, leaving the remainder positively charged. Such a positively charged atom is called a positive ion. The electron which is free, then attaches itself to a neutral atom, to form a negative ion. After ionization, the gas is in an electrically charged state, and a conductor of electricity. If we now charge the sphere in this conducting medium, the charge "leaks" or is conducted away.

The rate at which a charge leaks from a sphere cannot be measured, but an instrument which will measure the rate of leak of a charged body exists, and such an instrument is called an electroscope.

One of the fundamental laws of electrostatics is that like charges repel each other. If two fine gold leaves are joined together at one end and suspended vertically, and then charged with several hundred volts potential, the repulsion due to the charge causes the leaves to repel each other and to separate. If the leaves are insulated from the ground and surrounded by ordinary air, the charge will not leak readily from them and they will remain apart for hours or even days. If the air is ionized, the charge leaks off and the leaves fall together much more rapidly. The rate of fall is a measure of the conductivity of the gas.

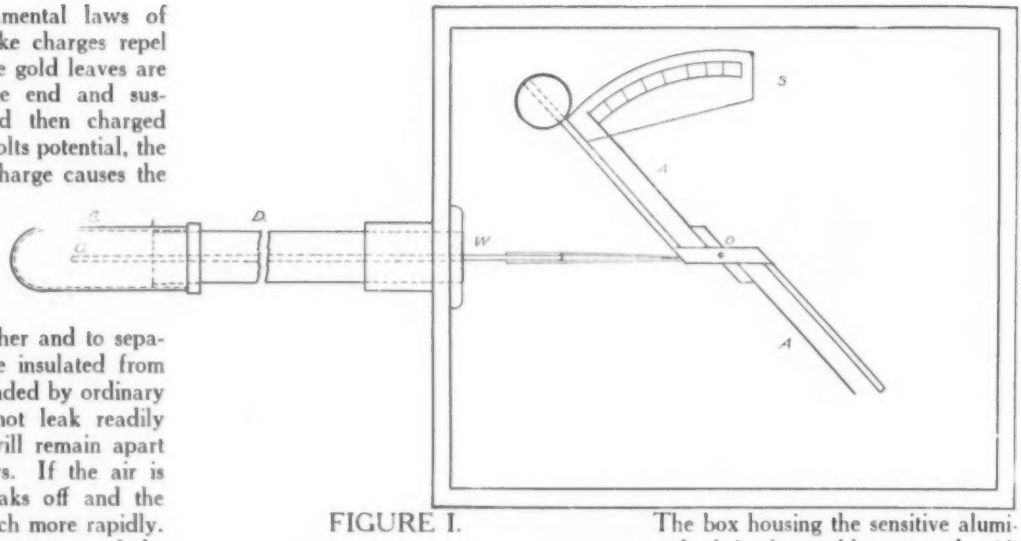


FIGURE I.

Application to the Measurement of X-rays

X-rays ionize air. Air so ionized conducts. We have an instrument for measuring its conductivity; hence, we can measure x-rays.

Figure 1 shows a diagrammatic sketch of the instrument.

"A" is a light aluminum leaf pivoted at "O" so that it swings in a horizontal plan. Its position may be read by means of the scale "S". To the needle at "O" is connected a wire "W" which passes along the inside of the brass tube "D" and is insulated therefrom. It terminates in the metal rod "C". "B" is a light aluminum cap which fits over "D" and is metallically connected to it. "B" and "C" constitute the ionization chamber. The whole system "AWOC" is thoroughly insulated from the ground, and so, if charged, will retain its potential, as measured by the constant deflection of the leaf. If now, x-rays pass through the chamber "B" they will ionize the air therein, and the charge will be conducted from "C" through the air to "B" and hence to ground. As the charge is conducted away from the system "AWOC" the aluminum leaf gradually falls to its normal position. If a great quantity of rays passes through the chamber, the conductivity of the gas becomes greater, and the rate of fall of the leaf greater.

Operation

To operate the instrument, the system "AWOC" is charged to a high potential by means of a static charger, after which the position of the needle on the scale is noted. The needle will retain its position for some time, gradually falling to the zero. This gradual "air leak" is unavoidable, due to the natural conductivity of the air. This natural leak under normal conditions is so much longer than the discharging time of the instrument under the influence of x-rays that it is a negligible factor.

The instrument is placed so that the ionization chamber ("B") occupies a position which would correspond to the center of the area to be rayed. The factors including kilovoltage, milliamperage, skin distance, and filter being previously set, the x-ray machine is started, and the time of fall of the leaf between two scale divisions is noted by means of a stop watch. Suppose, now, that the part to be treated is ten centimeters below the surface. The ionization chamber is placed beneath a block of paraffin [1] ten centimeters thick, the distance to the surface of the paraffin being the same as previously used for skin distance. The time of fall of the leaf between the same two divisions is again noted. Let the time of fall of the leaf at the skin be denoted by Ts and at the depth by Td. Then the per cent of the original beam penetrating to the depth of ten centimeters, under the conditions used will be:

$\frac{Ts \times 100}{Td}$. Thus, if Ts=10 seconds and Td=20 seconds, the per cent dose will be $\frac{10 \times 100}{20} = 50$.

Care of Instrument

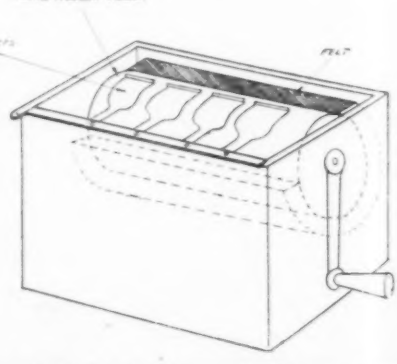
This instrument, embodying as it does, the principle of the electroscope, is extremely sensitive. It is a high class scientific instrument and must be treated as such. Any jars or knocks are likely to break the fine pivot bearings of the aluminum leaf. The instrument has been built with the utmost care and precision. The box housing the sensitive aluminum leaf is thoroughly encased with lead to prevent any stray radiations from entering and causing ionization. The air in the housing is kept dry by means of a small charge of calcium chloride.

The connecting wire between the electroscope and the ionization chamber is insulated from the grounded brass tube by means of a solid insulating material, which completely occupies all the space between the wire and the tube. This eliminates any possible error due to the presence of ionizable air in the tube.

The instrument is thoroughly grounded to prevent the accumulation of static.

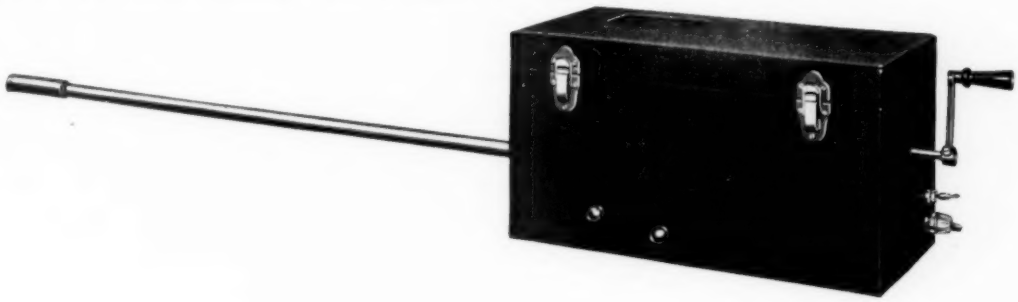
The Standard Ionotoquantimeter has been developed in our laboratories under the direct personal supervision of Dr. Robert S. Landauer. Dr. Landauer was for several years associated with Dr. G. L. Wendt at the University of Chicago, in a study of the effects of ionization in gases.

Drs. A. W. Erskine of Cedar Rapids, Iowa, and B. H. Orndoff, H. Schmitz, A. Bachem, R. A. Arens,



and E. L. Jenkinson of Chicago, were consulted frequently during construction of the Standard Iontoquantimeter and offered valuable suggestions and criticisms.

(1)—Instead of using paraffin it is considered better practice to use water. Paraffin is a few per cent less resistant than ordinary tissue, while the resistance of water corresponds very closely to that of tissue. However, paraffin is more convenient to use, and under average conditions is sufficiently accurate.



Acme Coronaless Overhead System

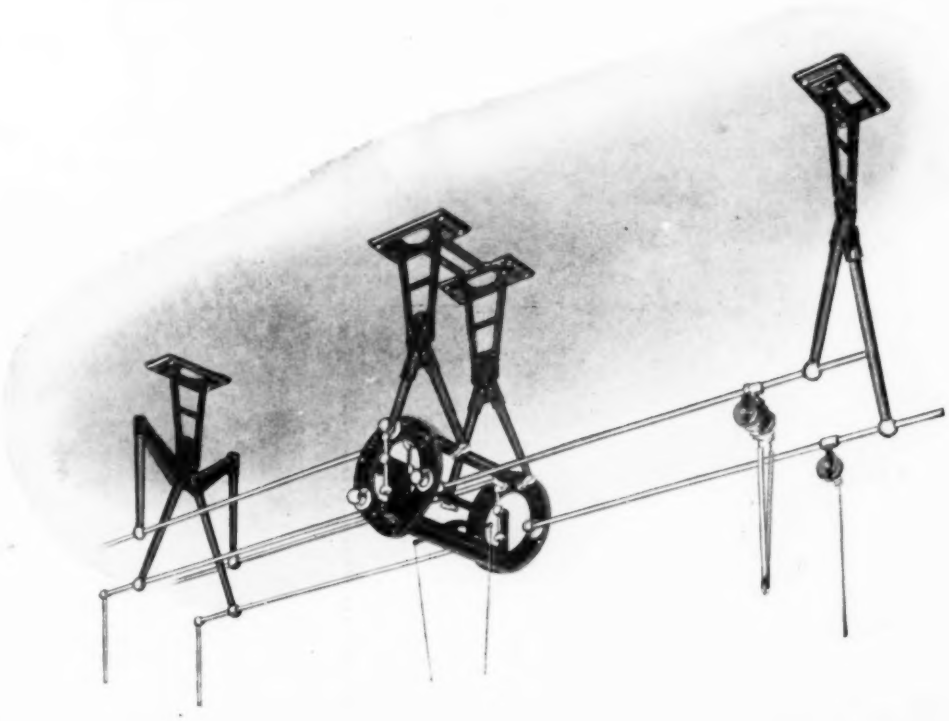
A RADICAL change in the design of high tension overhead systems is made in the coronaless system recently placed on the market by the Acme X-ray Co. of Chicago, Illinois. Excluding the body of the switch, no wood is used on any point of the system, all parts being made of metal and insulating materials. This makes the entire system very rigid and compact.

The high tension switch is capable of operating at 100 kv. (effective value). The body of the switch is made of wood finished in dull black enamel. The current carrying parts are so disposed on this frame that at no point is the path from negative to positive through any one piece of wood. In addition to this, the path through the air is made considerably shorter, so that if the switch is operated on a higher potential than that for which it is designed the sparkover will take place through the air instead of breaking down the switch.

The switch is of the toggle variety and good contact is assured because of the large amount of contact surface and the heavy pressure at the point of contact made possible by this movement. Because of the mechanical structure employed, the switch combines a very positive action with remarkable ease of movement.

Horizontal supports are entirely eliminated, thus preventing the accumulation of dust and the resultant partial conduction through it. A longer leakage path is also assured and breakdown of the insulation, due to the use of too high voltage, is prevented as the distance from tube to tube is shorter through the air than along the insulator.

The supports for the switch and insulators are designed so that they can be adjusted to allow for irregularities in the ceiling. In this way, perfect alignment of conductors, which is so necessary to the good appearance of the system, can be obtained.



Every possible contingency met with in the installation of high tension systems has been provided for. The system is complete in every detail and a combination will be found to meet every requirement.

Wappler Scale for Measuring Wave Length Radiations

DURING the early part of May, 1922, the Wappler Electric Company announced the perfection of a very simple device for the measurement of wave length radiations. From a reading of descriptive literature it would appear that this scale is patterned after the principle of the Benoist Penetrometer, with which most radiologists are familiar.

Following the experimental verification of the Planck-Einstein relation by Doctors Duane and Hunt, it has been possible to calculate the voltage of the current applied to the tube by measuring the wave length of the rays produced. The wave length is obtained from the angle at which the rays subtend when refracted upon the surface of a crystal.

Attempts to produce a satisfactory and accurate measuring device by March, Stauning and Fritz, resulted in a simple type crystal spectrometer. But the use of this instrument is a rather complicated matter, and its adjustments are so delicate that there is considerable question whether it will ever prove a practical instrument in the hands of the average practitioner.

It will be remembered that Professor Richtmyer recently published absorption coefficients for various metals at various wave lengths. These tables and curves show that copper and aluminum, vary at different rates for different penetrations or wave lengths. These data also indicate that aluminum is a relatively more effective filter for highly penetrating radiations than is copper, and conversely, for radiation of lesser penetration aluminum absorbs in greater proportion than copper. Accordingly, this fact constitutes the physical reason why copper as a filter is to be preferred over aluminum in highly penetrating radiations.

From these considerations the inference seems well founded that if the rays are passed through a uniform layer of copper next to which is located an aluminum wedge, there should be equality of tints on the photographic plate placed underneath and exposed through the metals. The point at which this effect of incidence harmonizes depends entirely on the wave length or penetrative power of the rays produced.

In principle the device in question consists of a uniform layer of copper and an aluminum wedge placed side by side. A photograph is taken through both the copper plate and the aluminum wedge simultaneously on one plate. After developing, from a scale which is reproduced on the photographic plate, the most effective or principal wave length or voltage can be directly read off. The calibration curve used for calibrating this instrument has been further extended and checked with voltages measured by standard methods and found to agree satisfactorily.

It is believed the instrument fills an important gap in simple and reliable measuring devices. For precision, simplicity and accuracy, it appears to be superior to many of the devices formerly employed.

Dr. Mutscheller of the Wappler Electric Company says that while this instrument was already completed and calibrated prior to the publication of an article in The American Journal of Roentgenology giving experimental curves from which such a type of instrument could be calibrated, comparison of Dr. Duane's data with those from Professor Richtmyer's absorption coefficients shows substantial agreement within the limits of experimental error.

ABSTRACTS and REVIEWS

X-ray Diagnosis of Gastric Ulcer. Olney A. Ambrose, M. D., J. Missouri M. A., May, 1922, p. 212.

MISTAKES are more frequently made in reading roentgenograms than in reading the shadows visualized by the fluoroscope.

It is seldom that diagnosis of a lesion of the gastro-intestinal tract can be truly rendered without taking symptoms into account. As a rule no abnormality of the gastro-intestinal tract is seen in patients who do not show symptoms directly referable to this region. The author never makes a diagnosis of a gastro-intestinal lesion until he has first proven that there is no other pathology to which the gastro-intestinal condition is secondary.

All findings must be correlated, and while he does not in any way belittle the value and importance of x-ray diagnosis, he insists that x-ray findings must be considered in connection with other findings. History he ranks first in importance, and complete physical examination second, emphasizing especially the examination of the circulatory, respiratory and nervous systems. Chemical analysis of secretions and excretions comes next in importance, and here he remarks that the fractional method, because not yet standardized, is of no greater value than the older method. Fluoroscopic findings he regards as of more value than roentgenographic findings alone.

The patient is permitted a soft diet the night before examination and the next morning is given four ounces of barium insoluble sulphate mixed thoroughly with water or buttermilk and made up with this medium to eight ounces. Five hours later a fluoroscopic examination is made, when it may be necessary to give more of the solution before palpation of the patient in both antero-posterior and oblique positions. The normal emptying time of the stomach in different individuals varies, but if barium remains in the stomach after five hours the writer calls it retention. A deformed duodenal cap such as indentation, niche, or a partial filling defect, or an accessory pocket are regarded as signs of duodenal ulcer.

After the above examination the hand is placed on the lower end of the stomach and everything is pressed upwards to note possible defects of the stomach. If direct signs of duodenal or gastric ulcer are present the patient is given one-fiftieth grain of atropin and later re-examined and then, if deformities are still present, real pathology is assumed to be the cause. If not completely satisfied at least three plates are then made for further study.

Indirect as well as direct signs are looked for while the patient drinks the barium. The indirect changes (changes of motility of the stomach) must be taken only for what they are really worth, as many conditions may cause them, but the author regards them as valuable. The *direct* signs can be relied on in about ninety per cent of the cases.

Veils in the Right Hypochondrium and Their Differentiation from Other Organic Lesions and Spasm. Lewis Gregory Cole, M. D., Am. J. Roentgenol, March, 1922, p. 137.

THE roentgen findings and clinical symptoms of these veils simulate cancer, gastric ulcer, or postpyloric ulcer or pylorospasm to such a degree that they require special consideration.

Only the "cobweb" adhesions in the right hypochondrium, which occur when the gall-bladder is apparently normal, are here considered.

Harris believes that this veil is an abnormal fold of the anterior mesogastrium, formerly called the "gastrohepatic ligament," and as described by him it extends from the gall-bladder to the descending duodenum. The writer thinks that this description applies only rarely to veils in the right hypochondrium, but states that veils certainly are present here and cause symptoms which sometimes require operation.

The roentgen findings characteristic of these veils are:

1. The cap and perhaps the extreme pyloric end of the stomach are partly constricted or compressed, and fail to fill to their normal dimensions, particularly on the anterior superior surface.

2. The left superior surface of the cap has a thin feathered-out appearance whereas the right side of the cap has a clear-cut, definite, well-defined line.

3. If the veil also involves the extreme pyloric end of the lesser curvature of the stomach this region has a puckered appearance somewhat simulating the finding observed in cases of prepyloric folds.

4. The pyloric sphincter is clear cut and well defined if the veil involves only the cap. If it involves the stomach also, the pyloric sphincter, particularly on the lesser curvature surface of the lumen, is irregular and often thickened by comparison with the sphincter on the opposite side of the lumen.

5. The deformity is more marked with the patient in the erect or prone posture, and may be absent with the patient lying on the right side.

6. The line or torsion runs downward and to the right from the gastrohepatic ligament (megogastrium) toward the gall-bladder, the under surface of the liver, or the hepatic flexure.

7. These veils are rarely if ever obstructive to the pylorus, and if gastric retention occurs it is probably functional rather than organic.

8. If the veil fails to extend as far up as the cap or stomach, it may then involve only the anterior surface of the descending duodenum, causing that to be adherent to the under surface of the liver, gall-bladder or hepatic flexure. This is the type of pathology described by Harris, but the author has seen no case where the veil is limited to the descending duodenum.

9. There may be an angulation, rarely amounting to a partial obstruction, involving the midportion of the descending duodenum.

In about ten per cent of cases the author has found difficulty in the differential diagnosis between cancer, ulcer, gall-bladder adhesions, spasm, and this veil or membrane. In such cases the surgeon should be forewarned so that he may look for a veil in event of failure to find other pathology. It requires as much surgical skill and experience to recognize these veils after the abdomen is opened as it requires roentgenological skill and experience to interpret the x-ray plates.

The author and Dr. J. P. Hoguet contemplate collaboration in writing a monograph upon this subject in the near future.

Possibilities of Roentgen Ray Treatment in Cancer of the Pancreas. G. E. Richards, M. B., Am. J. Roentgenol., March, 1922, p. 150.

THE author's report is based upon only a few cases, but is presented with the hope of stimulating interest in a subject which he feels holds possibilities worthy of investigation.

Two patients out of three treated are apparently well nearly a year after

treatment; the other one is dead. All three cases were proven by every means possible to be cancer of the pancreas, and the hope of life was not held out to any of these before roentgen ray treatment.

Some other cases have shown gratifying preliminary results, but treatment has been too recent to allow of conclusions in regard to these.

From his experience with this form of treatment the author concludes:

1. It is possible favorably to influence the growth of pancreatic cancer, and this is sufficient justification for intensive radiation of every case as soon as the diagnosis can be established.

2. It appears that adenocarcinoma of the pancreas is more susceptible to irradiation than are some other forms of adenocarcinoma.

3. Efforts should be made to perfect our ability to recognize the disease as early as possible.

Personal Observations Regarding the New Roentgen Technique for the Treatment of Cancer. J. Henry Schroeder, M. D., Ohio M. J., May, 1922, p. 345.

THIS paper gives a brief exposition of the biological effects and the physics of radiation and describes the apparatus and technique for the benefit of the general practitioner.

The writer's observations, made in German clinics, are recounted as follows: "The best results have been obtained in the treatment of cancer of the uterus and the pelvic organs. In the University Gynecological Clinics at Erlangen and Freiburg no surgical operations for uterine cancer have been done during the past five or six years. All cases are treated by roentgen radiation, sometimes in conjunction with radium. Professor Wintz accomplishes what he designates as the Roentgen-Wertheim operation in three roentgen treatments. In the various surgical and gynecological clinics throughout Germany equipment for intensive deep roentgen treatment is at hand. There are usually from two to four machines running eight to ten hours per day.

"For cancer in locations elsewhere than in the pelvis, though equally applicable, roentgen therapy has not been as uniformly successful. An exception to this statement is found in cancer of the breast."

The author has installed an apparatus with a capacity of two hundred and eighty-five thousand volts maxi- dose at ten cm. of over sixty-five per mum, capable of delivering a depth cent of the skin dose, through one area of entry, when filtered through heavy copper filters. Final results, of course, are not yet apparent.

The Relation of Temperature Changes to Roentgen Ray Skin Reactions. Charles L. Martin, M. D., *and* George T. Caldwell, Ph. D., M. D., Am. J. Roentgenol, March, 1922, p. 152.

THE two extreme views with regard to idiosyncrasy are discussed and are summarized by the statement that the consensus of opinion is that there is a definite susceptibility of the skin of too small a degree to be called an idiosyncrasy; many factors influence this and skin temperature is the one herein discussed.

To throw some light upon this subject a series of experiments was undertaken upon rabbits. These experiments are as yet incomplete, but the following conclusions have been drawn from the preliminary work:

1. Adhesive plaster appears to produce ulcerations upon its removal from an irradiated skin surface.

2. The evidence at hand suggests that a covering placed over irradiated skin causes some increase in the reaction. This may or may not be due to an increase in the temperature of the skin.

3. Cooling the skin by means of an ice bag for several days after irradiation seems to accentuate the reaction obtained.

An Original Method for Lantern Slide Projection of Roentgen Ray Films. Norval H. Pierce, M. D., Jour. A. M. A., May 20, 1922, p. 1539.

TO obviate inversion of colors in plates used for lantern slides it is not necessary to make a second plate from the first, "one may simply place a lantern slide cover plate over the desired portion of the film and cut it out. This portion of the film is then placed between two cover plates, and the edges are covered with passepartout. The slide is now ready for projection and will appear on the screen as it does upon the film as regards black and white, without loss of detail."

Radiation Treatment of Uterine Cancer. A. F. Tyler, M. D., Nebraska M. J., May, 1922, p. 162.

CANCER of the female genital organs ranks second in the mortality rate of cancer in the Unitied States. Cancer of the uterus is the most frequent type found, it is found commonly at the cervix, but rarely in the body of the uterus. This latter condition usually allows surgical treatment, but if not radiation is of great value.

Surgical results in carcinoma of the cervix are very disappointing, because patients present themselves too late; radiation therapy has a large field here and even with hopelessly inoperable cases results have often been brilliant and the future holds great promise.

A monotherapy method in malignancy is condemned. Radiation from without and within and surgical treatment where indicated should be used.

The advantages of radiation therapy are: No immediate operative mortality, no anesthetic required as a rule, a short hospital stay, treatment can be re-applied, and all possible lymphatic metastases can be successfully reached.

Two cases of carcinoma of the cervix and one of the vaginal vault are recounted with successful results following radiation treatment.

"Experience has shown that we should introduce the radium into the cervical canal, when this is possible without traumatizing; that radium should be placed against the cervix in the vaginal vault and some radiation should be allowed to impinge upon the walls of the vaginal vault, but we should keep the walls far enough away from the radium so that they do not get too much reaction." Otherwise fistula or occlusion of the vaginal lumen may occur. The radium can be mounted upon dental modeling compound, or gauze may be packed into the vagina so as to keep the walls from the radium applicator, or a metal shield can be used for protection of these parts. Sometimes a lead slug with radium mounted upon one side is used.

Radium in Cancer of the Prostate. Herman C. Bumpus, Jr., M. D., Jour. A. M. A., May 6, 1922, p. 1374.

THIS is a report of two hundred cases from the Mayo Clinic. There are records of seven hundred and twenty-nine patients with carcinoma of the prostate; two hundred and seventeen of these have been treated with radium during the last seven years, and three hundred and sixty-three have not been treated, which gives a basis for comparison.

CONCLUSIONS

"1. Radium therapy should be applied in less than one-half of the patients with carcinoma of the prostate. (2) One-third of all patients with carcinoma of the prostate will be found to have metastasis at the primary examination. (3) Complete and thorough irradiation of all portions of the neoplasm with minimal doses applied from many locations affords better results than maximum doses applied from a few locations. (4) Prolongation of

life can be expected in only one-fourth of the patients treated."

Diagnosis of Gall-Bladder Disease. William Fitch Cheney, M. D., Jour. A. M. A., April 29, 1922, p. 1281.

THE subject is discussed under the heading of physical examination, laboratory examination, fluoroscopy and roentgenography, and interpretation of data. The paragraph upon fluoroscopy and roentgenography is here quoted verbatim:

"No one can doubt by this time the value of fluoroscopy and roentgenography in diagnosis. Nevertheless, the evidence given by this method of diagnosis is not infallible and must not be accepted as unassailable. In a given case of gall-bladder disease, it may add nothing to the data collected by the history, physical examination and laboratory findings; and yet its negative report must not be understood to prove all other witnesses wrong. On the other hand, it may appear to implicate the gall-bladder when no disease is there, and call attention to abnormalties that are shown by operation not to be present. It is not fair, therefore, to exalt this method of diagnosis to a pedestal above all others or to claim for its pronouncements the rank of Delphic oracles.

"The evidence obtained by roentgen ray examination is of three kinds: direct, indirect and eliminative.

"1. Direct evidence means the demonstration of changes in the gall-bladder itself, either the shadow of its outlines or of stones within it. But it is admitted that not more than half the cases show such peculiarities in the films even when they really exist in the body; and, unfortunately, at times they show in the films when they do not exist in the body, as proved later at operation. The margin of error is, therefore, a large one, and neither positive nor negative reports are so reliable that they must be accepted if they conflict with the data obtained by other methods.

"2. Indirect evidence means the demonstration given of effects produced on surrounding tissues by gall-bladder disease, such as flattening or deformity of the duodenal cap, reverse peristalsis in the duodenum, displacement of the stomach to the right, or a high fixed position of the hepatic flexure of the colon. All of these signs are produced by pericholecystitis with resultant adhesions between the gall-bladder and adjacent organs. But pericholecystitis does not always occur as a complication of chronic cholecystitis, and, therefore, none of these results may follow. Their absence is not conclusive evidence against gall-bladder disease, just as their presence may be the result of localized peritonitis originating from disease in the pylorus, duodenum or colon, rather than in the gall-bladder.

"3. Eliminative evidence means the proof given of normal stomach contour and motility, showing that the digestive symptoms are not due to organic disease of that viscus, of no defects in the duodenum, such as are ordinarily found in chronic ulcer, of no cecal or appendix stasis or other evidences of a chronic appendicitis, and of no break in the continuity of the ascending or the transverse colon." These negative findings are of great value, even though no positive signs of gall-bladder disease are demonstrated.

Radiotherapy and Electro-Coagulation in the Treatment of Malignant Disease. George E. Pfahler, M. D., *and* Bernard P. Widmann, M. D., J. Maine M. A., April, 1922, p. 246.

THE writers believe that pre-operative and postoperative radiation should always be used in operations upon malignancies.

Epithelioma of the skin, if treated early and thoroughly (presumably radiotherapy) should get well. Basal cell epithelioma the authors generally destroy by the high frequency spark and follow this with a full erythema dose of roentgen rays. This method should not be used about the eyelids because contraction may occur from the resultant scar, though with proper and careful technique it may be used; radium, however, can be safely used here.

Electro-coagulation is also used for squamous celled epithelioma and is followed by roentgen ray or radium treatment. Epithelioma of the tongue can be successfully treated by this means if taken early, but that of the cheek is extremely difficult to treat successfully.

For carcinoma of the breast preoperative radiation followed by operation and postoperative radiation is advocated, but if inoperable radiotherapy offers reasonable hope of success. In recurrences and metastases patients have been known to remain well for periods of years.

In carcinoma of the uterus the great progress made by radiotherapy is progressively diminishing the operative field but " it is far better that a skillful surgeon operate than that a bungling therapeutist should treat patients." Proper choice of cases is necessary.

For sarcoma radiation is preferable to excision.

Conclusions drawn are: (1) Radiotherapy, when practical, should be used preceding and following operations. (2) Electro-coagulation can in many instances be used to replace excision, and to advantage, because the blood vessels and lymphatics are sealed off in the process of destruction and there is a heat zone beyond the area of actual destruction which will destroy carcinoma. (3) Radiotherapy can be used with success in nearly all of the superficial cancers. (4) Radiotherapy will in some instances cause a complete disappearance of even deep seated disease."

The Roentgen Diagnosis of Pulmonary Tuberculosis in Childhood. R. G. Allison, M. D., *and* R. W. Morse, M. D., The Journal-Lancet, May, 1922, p. 247.

THE work of Kuss, Albrecht, Hamburger and Sluka, Opie and Dunham, also Gohn of Vienna, is reviewed and a report is submitted of a study upon tuberculosis suspects among the grade pupils of Minneapolis schools.

The authors' conclusions are as follows:

1. The primary lung focus in childhood tuberculosis practically always occurs in the parenchyma of the lung and is by the inhalation route.

2. Involvement of the regional lymph nodes and hilus glands is the rule and is secondary to the primary lung focus.

3. The prognosis in primary pulmonary tuberculosis of children is directly dependent on the age at which infection takes place. It is grave during the first two or three years of life and relatively unimportant occurring after this time.

4. Enlargement of the bronchial glands and alteration in the linear markings should not be considered tuberculous in the absence of calcification or a definite primary focus.

5. Adult type tuberculosis occurring either in the child or adult is always a second infection, which is generally from without and by the inhalation route. Its occurrence in childhood is rare and offers a grave prognosis.

A Review of a Year's Thyroid Work. Frank H. Lahey, M. D., Bost. M. & S. J., April 27, 1922, p. 562.

THE writer believes that many errors in thyroid treatment are constantly being made because of an inadequate knowledge of the clinical classification of thyroid disease and ignorance of the indications for operation in each group.

Adolescent goiter with slight enlargement requires no treatment and the writer doubts if this form of goiter is anything but so-called. Colloid ado-

lescent goiter seen in goiter belts is a different type.

Neither does he believe that there is necessarily a relation between tachycardia and enlargement when both are present. He does not believe that tachycardia of thyroid origin exists without other signs indicative of this disease, nor that the combined presence of tachycardia and enlargement are necessarily related. These two conditions may exist even with a moderate increase in the basal metabolic rate without hyperthyroidism being present. On the other hand, if hyperthyroidism is present tachycardia and increased basal metabolic rate will be present also, but goiter may exist without hyperthyroidism, and vice versa.

Colloid goiters and cysts, when unsightly or intrathoracic or associated with hyperthyroidism, he would operate upon, also upon the latter when they produce pressure. Adenomata he believes should be operated upon if they are producing secondary hyperthyroidism or if they present danger of malignancy, this latter being especially stressed.

In regard to the metabolic test, while the author's study is not yet complete, certain facts have been impressed by this study, "The first and most important one, in our opinion, is that hyperthyroidism has not occurred in this group (five hundred cases) without an increase in basal metabolism rate, so that we feel strongly that operations undertaken upon patients with normal metabolisms will yield consistently poor results * * *"

"Finally * * * it is a very grave error to consider thyroid disease in terms of increased metabolism, and * * * such a test can be of as much harm as good unless carefully weighed and correlated with the history and clinical signs presented by the individual."

Hearts in hyperthyroidism fall into two classes, one shows no signs, upon clinical examination, of heart damage, the smaller class shows definite signs of this.

The writer's attitude toward x-ray therapy is exceedingly skeptical. Experimental work tried out under his management and with his selection of cases and interpretation as to cure or relief at the Boston City Hospital, leads him to conclude that surgery is preferable to x-ray therapy. Endeavoring to be fair he states that the cases have been limited in number, and that as a clinician and not a trained roentgenologist, he has had no check upon the dosage, but he immediately counters this statement by one asserting absolute confidence in the accuracy of the dosage employed by the roentgenologist in charge.

The Value of Basal Metabolic Rate Determination and the Epinephrin Test in the Diagnosis and Treatment of Thyroid Disorders. Emil Goetsch, M. D., Long Island, M. J., April, 1922, p. 154.

THREE of the most practical and helpful tests for thyroid disorders are based upon three functions of the thyroid secretion, namely, "(1) its stimulating action upon the sympathetic portion of the autonomic nervous system rendering it hypersensitive to the action of epinephrin, (2) its stimulating or depressing action upon metabolic processes according to the amount of secretion present, and (3) its effect upon the mobilization of carbohydrates, particularly in the liver, and a retarding action upon the combustion of sugar in the blood, as a result of which hyperglycemia follows when this secretion is present in increased amounts."

The hyperglycemia test for hyperthyroidism is less valuable than the epinephrin and metabolic tests since the carbohydrate changes are not specific for thyroid disturbances and hyperglycemia is influenced by many other factors necessitating their ruling out before the test can be of value here.

Abundant physiological research has shown that the sympathetic nervous system is hypersensitive to epinephrin chlorid and that there is an increased tolerance to injection of epinephrin in states of clinical hyperthyroidism or after thyroidectomy in animals.

This knowledge the writer applied to a study of approximately eight hundred patients suffering disorders of the thyroid gland. All cases were carefully verified by histological study of operative material, and as a result the writer's clinical test for hyperthyroidism was evolved, which, briefly described, is this: "The status of the patient at rest is carefully noted, with particular reference to the pulse, blood pressure, respiration, and the subjective and objective findings such as nervousness, tremor, throbbing, asthenia and vasomotor changes. A hypodermic injection of 0.5 cc. of epinephrin chlorid is then given. Any changes in the findings are carefully noted over a period of an hour to an hour and a half and then compared with the status of the patient before the injection of the drug. A positive test always confirms and usually establishes the diagnosis of hyperthyroidism."

The symptoms following positive and mild reactions to the test are described, these are never dangerous and the majority of them must be present and must be considered together with the entire clinical picture in order to establish a positive diagnosis.

In exopthalmic goiter (test usually unnecessary) the epinephrin reaction the writer found to be uniformly positive and parallel with the sevrity of the symptoms. In colloid goiter without symptoms of hyperthyroidism the reaction is negative. In active adenoma with clinical symptoms of hyperthyroidism the reaction is positive.

In obscure cases presenting a hyperthyroid syndrome a positive epinephrin test has often led the writer to advise operation at which adenomata, too small to be seen or palpated, have often been found and their removal has led to striking benefits.

Patients with diffuse adenomatosis are often mistakenly thought to have tuberculosis, neurasthenia, psychoneurosis, effort syndrome, etc.; the metabolic rate is not increased in these cases and they are therefore overlooked. A positive reaction to the epinephrin test led to operation in fifteen such cases with considerable consequent success.

The epinephrin test is also a guide to the amount of thyroid extract administered in cases of hyperthyroidism, myxedema and cretinism.

As a guide to differential diagnosis in tuberculosis, psychasthenia, psychoneurosis, hysteria, neurasthenia, dementia precox, melancholia, alcoholism, tabagism, acromegaly and arteriosclerosis as well as in some other diseases, the test is of great value as essentially negative results are given.

The writer does not hold that the test is absolutely pathognomic of hypertrophied states—there are a few states which give a more or less typical reaction, but careful history and physical examination clears up such cases. The test is practically always confirmatory, in some other cases diagnostic and in other suggestive.

The test is readily understood, performed and interpreted, having an advantage here over the basal metabolic rate test. In mild and latent cases of hyperthyroidism it is more sensitive than the basal metabolic rate test, though this latter test is of distinct advantage in early diagnosis of hyperthyroidism and is a very useful guide to the form of therapy demanded by the case in hand, and also functions usefully as a check during treatment. The faulty technique and interpretation of this test are briefly dwelt upon.

The Roentgen Rays as an Aid in the Diagnosis of Diseases of the Mastoids and Nasal Sinuses. Joseph Asprey, M. D., Northwestern Med., May, 1922, p. 136.

NO originality is laid claim to by the author. He states that his thesis represents an endeavor to correlate and repeat certain ideas, facts, and observations with the hope that a more frequent use of the roentgen rays in the conditions under discussion will be stimulated and found to be helpful; he believes that the value of the rays is not yet appreciated as it should be, not only in positive or suspected mastoids, but in sinuses.

His conclusions are as follows:

"1. Recognition of the infantile type of mastoid in cases with middle ear infection, plus a drooping of the superior canal wall, calls for exploration of the antrum early, even without clinical signs of mastoids, thereby eliminating a large percentage of chronic mastoids and brain abscesses.

"2. The presence of the pneumatic type of mastoid with definite evidences of mastoiditis, but without cell necrosis or bone absorption, does not always call for immediate operation other than paracentesis of the ear drum.

"3. Information gained by radiographic examination of mastoids with knowledge of the structural type enables us to more definitely predict the clinical course and prognosis of middle-ear infections.

"4. Proper technique with films from different positions and intelligent interpretations are of definite value in diseases of all the nasal accessory sinuses and of all suspicious or pathologic mastoids."

The Value of Interstitial Radiation. Douglas Quick, M. B. (Tor.), Am. J. Roentgenol., March, 1922, p. 161.

WORK now under way may place radium in the class of constitutional agents, but until such time the problem of more accurate radium application calls for attention.

The history of radium technique is outlined up to the advent of therapy by means of radium emanation in buried tubes, which has now reached a practical working standard. The smaller tubes and needle and the fact that the trocar needle is withdrawn reduces the necessary trauma, and properly used will not result in necrosis about the buried tubes. Equal distribution (using more tubes of buried individual value if necessary) and keeping well to the periphery of the growth is very important, since the periphery represents the actively growing and infiltrating border. When practical, emanation should be implanted in the healthy tissue just at or as near as possible to the infiltrating base of the neoplasm. The writer believes the greatest use of radium in the future will be in this direction.

All new growths of distinct bulk can best be managed by interstitial imbedding and this method is also useful when it is found impossible to keep surface applications in place. The treatment of primary intraoral lesions excludes surgery altogether in the writer's clinic.

In rectal, uterine, and breast groups interstitial radiation has played a part which could otherwise not have been handled. This is true also of parotid tumors.

The method has been used in all neck wounds following neck dissections and in tumors found inoperable upon incision. Complete regression from one to four years has followed.

There are important possibilities for the use of this method in intra-abdominal new growths.

The Diaphragmatic Pinchcock in So-Called Cardiospasm. Chevalier Jackson, M. D., Reprint from *The Laryngoscope*, January, 1922.

"IN the past different pathological conditions have been erroneously classed under cardiospasm." The author has demonstrated that the stenosis is not at the cardia and Mosher has demonstrated that it is not always spasmodic. This has been further confirmed by clinical observation. Out of hundreds of cases of so-called cardiospasm the author has found none in which the spasm at the hiatus was greater than a maximum normal. His conclusions are:

"1. The diaphragmatic pinchcock is the normal mechanism by which, along with kinking of the esophagus, the food in the stomach is prevented from regurgitation.

"2. The diaphragmatic pinchcock opens at the proper moment in the deglutitory cycle.

"3. It is the failure of the diaphragmatic pinchcock to open normally that constitutes the stenosis in so-called 'cardiospasm,' and not an excessive degree of spasmodic contraction.

"4. The diaphragmatic pinchcock is the local mechanical means by which the esophageal stenosis is produced in those cases of so-called cardiospasm in which the condition is really a spasmodic one."

Pneumoperitoneum as Aid in the Roentgenologic Diagnosis of Lesions of the Urinary Tract. L. R. Sante, M. D., Reprint from Jour. A. M. A., 77:982, Sept. 24, 1921.

PNEUMOPERITONEUM has greatly enhanced the diagnostic value of the x-ray, although the full value of this method is not yet known. The point has been reached, however, where more specific examinations may be conducted by this method than at first, and the method can be used without great discomfort to the patient and with comparative safety. Conception of the normal is of course a prime requisite for a working basis.

The method can be used to determine the presence, position, size, form or outline, mobility and attachments of the kidney, and these specific points are all dealt with in the original paper; tuberculosis of the kidney and small carcinomatous nodules which can not be palpated can be detected as can also congenital cystic kidney.

The demonstration of intra-abdominal masses and the determination of their origin and attachment is possible. The retroperitoneal character of masses can be established and their involvement of the kidney determined.

The method is valuable also in the diagnosis of special conditions peculiar to urinary tract examination, but examination of the kidney for stone by this method should not be made until all else has failed. "Shadows suspicious of stone over the kidney area can be definitely localized to the kidney. Injection of opaque material into the ureter and kidney pelvis can in most instances be observed during its injection, giving valuable information as to obstruction from kink or stricture of the ureter. Observations of the bladder wall are possible and the connections of pelvic masses to the bladder can be shown."

Details of technique are given in the original paper.

More About Actinic Rays. Howard Plank, M. D., Am. J. Electroth., April, 1922, p. 109.

THE author expresses considerable satisfaction with the rceognition that is now being given actinic rays by the general medical profession.

Data are at hand and evidence will shortly be submitted proving that chemical changes are produced by the action of the actinic rays upon the blood.

It is positively stated that if the actinic rays are given after a series of x-ray treatments that the x-ray treatment may then be renewed and increased without danger from surface burns.

Gastric ulcer, dry gangrene, and fistula are some of the lesions successfully treated by the writer.

Electrical Methods in the Treatment of Tonsils. William D. McFee, M. D., Am. J. Electroth., April, 1922, p. 112.

"THE only contraindications for electro-dessication treatment are submerged tonsils and in children below ten years of age." The advantages of this treatment are no confinement or after care, no anesthesia, no pain, no traumatism, no hemorrhage, sepsis or other dangerous complications, and no recurrence if thoroughly and properly treated. The chief disadvantage is that it takes more time, the average case takes about six weeks to reach its maximum of improvement. "Hypertrophy is reduced in practically all cases to that of normal, and even less than normal in size, and crypts are obliterated. The resulting scar tissue also forms a protective covering to the tonsil surface. * * * In a series of more than one hundred cases extending over a period of fifteen years there has been no appreciable recurrence of tonsil tissue, and the tonsil did not again become the seat of diseased processes."

The technique is described and notation made as to proper selection of cases.

Radiology and Physics. G. W. C. Kaye, O. B. E., M. A., D. Sc., Arch. Radiol. and Electroth., April, 1922, p. 336.

A KNOWLEDGE of physics is greatly lacking and greatly needed in the medical profession. It is especially detrimental to radiologists that the medical curriculum, heretofore, has held the study of physics to be of so little importance. "They have grown to realize the enormous part that radiology will play in medicine in the future and they further realize that if radiology is to advance as it should they will have to correlate it continuously with physics, which is ever advancing."

German achievements in radiology have always been due to the fact that the German "discovered that the secret of progress in radiology was to bring the medical man and physicist continually together and let them work side by side. He went further and introduced them to the manufacturer, but that is another story." The question is asked whether the British radiologist is in a position to submit rival techniques, backed up with a corresponding wealth of physical and scientific data.

The suggestion is made that the Royal Society of Medicine give whole hearted support to securing the appointment of part or full time physicists to the various hospitals, and further, to insure that the universities and other teaching centers provide physicists with courses of instruction calculated to turn out men of the right calibre and training.

The greater part of the paper deals with the subjects of the physics of the x-ray spectrum, absorption and scattering. A suggestive statement is that while there is knowledge of the existence of over thirteen octaves of x-rays, or including radium gamma rays nearly sixteen octaves, the radiologist has as yet turned only about three octaves of these to account.

Greater unity and co-operation in all phases of the work is urged.

The Care of Radium in the Hospital. Howard A. Kelly, M. D., Mod. Hosp., May, 1922, p. 407.

FOR the preservation and for the protection of workers, precautions must be taken and carelessness and theft also must be provided against.

Some one person should be responsible for knowing at all times just where the radium is, and this individual should keep count each time it is changed and also check it upon its return to the safe.

In the clinic at Johns Hopkins Hospital the workers are protected by cutting down to a minimum the exposure of the personnel, by screening off the radiation while the emanation is being pumped off and manipulated in transferance to its final containers, and by eliminating the dangers from unavoidable leaks by means of strong ventilating fans which rapidly change the atmosphere of the room. Also the staff of technicians is composed of six, each individual serving one day a week, which avoids the cumulative effect upon the blood and does not impede the worker's efficiency by long periods of detachment from duty.

Furthermore, the very simple pumping apparatus in the vault shortens the time of exposure, the pumping may take from twenty minutes to one hour. Around the bulbs which contain the stock radium solution is disposed a three inch lead wall between the operator and the radium, in which a ton and one-half of lead was used. When the emanation is being pumped out of the inner apparatus and while it is being propelled through the glass tubing to the mercury bath where it is collected the operator is protected by a screen of lead one inch thick. During the early stages the emanation is not as dangerous as it is later on.

In placing the emanation into apparatus for treatment the nurse is protected by the radium being placed in a lead lined box, which rests upon an iron safe in which needle points are kept, and which has a heavy lead upright plate, in front of which she stands, thus protecting the breast and thyroid. Direct contacts are avoided by using forceps and tongs twelve to fifteen inches long. When taken from here for treatments the emanation is held as far as possible from the body and is then kept at a distant point of the room until the moment it is needed.

A head nurse remains permanently on duty as instructress, but never gives treatments.

The three other nurses remain on duty for six weeks at a time, alternating two weeks of day work with two weeks of night work.

The blood of doctors and technicians is examined at regular monthly intervals and that of nurses is examined upon entering service and upon leaving at the end of the six weeks period. Great individual differences in the resistance to blood changes are discovered and it has been found possible to select a group for this duty who are not susceptible to the rays, and these nurses are not called upon to serve oftener than once a year, and it is thought that this can soon be changed to once in six months with safety.

Dental Roentgenography in the Light of Clinical and Pathological Findings. Allan Scott Wolfe, D. D. S., Am. J. Roentgenol. March, 1922, p. 186.

AN oral film alone does not give sufficient basis to decide upon either retention or elimination of teeth. A knowledge of oral anatomy and histology, so often made use of, are apt to lead to mistakes and almost invariably this is true if no check is exercised. Gross errors arising from an ignorance of anatomy (the dental foramen, etc.) are mentioned briefly. This lack of knowledge must be replaced by accurate knowledge, far greater than most roentgenologists now possess.

With this knowledge of anatomy the next requisite is that films of each side of the oral cavity be taken and compared. Two or three films are not enough upon which to base diagnosis. It must be kept in mind that the results of infection and not the infection are what is produced upon the film, and even then it must be remembered that appearances are often deceitful.

Most dental operations are failures in the long run. Retreatment of teeth is condemned and over-elimination rather than under-elimination is advised. "The encysted area is nothing more than a slow-growing mass at the apices of pulpless teeth * * may be granuloma or cyst, sterile or infected; it makes very little difference. It should be removed after extraction

with a dull curette, otherwise the extraction of teeth is useless."

Morbid conditions are classified as apical, pyorrheal, and nerve irritants. Added to these are "the lower border of the maxillary sinus and injury to the maxillary bone such as a fracture."

In systemic pyorrhea (all cancellated bone over all the teeth permeated with pus) elimination is called for; but the disturbance may be local and due to lack of contact, to contour, or to poor occlusion, and in these cases aid may be given without extraction.

Impacted teeth, hypercementosis and pulp nodules are discussed in relation to nerve irritation, also dental conditions connected with pathology of the maxillary sinus are discussed.

The author states his practice is this: "In all cases of systemic infection or nerve irritation, accompanied by lowed resistance, it is my practice to eliminate entirely all pulpless teeth which show a break in the peridental membrane, and also nerve irritants (such as retained cysts or residual infection, pulp nodules, hidden cavities) never venturing an opinion upon roentgenographic evidence alone without clinical observation."

Remarks on the Dosage of Radium and the Form and Method of Its Application. Carroll Chase, M. D., Reprint from the Urologic and Cutaneous Review, January, 1922.

THIS paper considers the proper amount and form in which to use radium and the proper method of its application.

The amount to be used depends upon the condition to be treated, and to state the minimum amount of radium necessary to treat the entire range of cases is considered a difficult problem —from one hundred to several hundred milligrams is given as a probable range. The cases that can be treated with small quantities, when the general run of cases is considered, are in the minority. The quantity to be used to advantage can often be determined only by experience.

The proper form in which to use radium is often difficult of determination, and widely speaking, the choice lies between a salt of radium and its emanation. In superficial disease flat varnished applicators may be used, or radium salt in tiny glass tubes gives much the same effect when lightly screened. Radium emanation can best be used in practically all cases where the salt of radium is indicated. It is not easy always to decide upon the proper form of application, particularly as increased knowledge and experience are constantly bringing changes in technique.

To treat conscientiously all the widely varied cases suitable for radium therapy it is necessary to have a sufficient quantity of emanation in one of the following forms: First, a steady source of emanation in very considerable amount, some of which must be in the form of tiny glass seeds of one to two millicuries each; second, enough of a salt of radium contained in small platinum-iridium needles, and besides this a further supply either in the form of varnished applicators or in the usual small glass tubes, the platinum needles alone are not suitable for all cases; third, enough emanation to use in selected cases, as well as a sufficient quantity of a salt of radium, partly in needles and the rest in the form of varnished applicators, or in the small glass tubes.

The choice of method is too broad a subject to be treated in a short article, but there are four basic factors to be kept in mind in regard to this, namely, the amount, the time, screening, and distance. The practice of stating the dosage in terms of milligram hours is not scientific, since the effect of one milligram applied for one hundred hours and one hundred milligrams applied for one hour is not the same. Often it is wise to give one large dose instead of several smaller ones at intervals, particularly is this true in surface cancer.

Time should be stated in minutes or hours, and this factor varies greatly with the condition under treatment.

Screening varies greatly from none at all to two or more millimeters of lead, and the advantages of the different filters are taken up in this section and secondary filters are also discussed.

The question of distance is frequently too little considered and too little understood.

"The internal use of radium, whether by intra-venous injection, by drinking water, or by other methods, has, perhaps, not made the progress in this country that it should. Its usefulness in a wide variety of diseases has long been proved by the excellent results obtained at the various mineral springs, both here and abroad."

American Literature on Radium and Radium Therapy Prior to 1906. Carroll Chase, M. D., Am. J. Roentgenol., December, 1921, p. 766.

THIS article is a brief resume of the history of radium and contains a valuable bibliography upon the subject, dating from 1906 and including books, articles and editorials from medical journals upon the subjects named in the title above.

Tumors Involving the Oral Cavity, Upper Respiratory Passages, and Ears, and Some Observations Following the Use of Radium. Margaret Armstrong, M. D., J. Iowa M. S., May, 1922, p. 187.

THIS paper gives a comprehensive description of oral tumors.

The so-called epulis, the giant cell and round cell spindle mixed and melanotic sarcoma are first described.

The embryology of the teeth is reviewed to give a basis for adequate explanation of the origin and development of dental tumors. Under this heading root cysts, simple dentigerous cysts, multilocular cysts, and solid odontomata are described.

Carcinomata of the oral cavity are next dealt with, their incidence, etiology, location and prognosis discussed. Carcinomata of the pharynx and tonsils as well as sarcomata and benign growths in these regions are treated throughout several paragraphs.

Radium offers the best chance of cure or relief of these neoplasms, but surgery should in some cases be combined with this treatment.

Three case reports are appended.

Two Advanced Cases of Carcinoma of the Face—A Warning Against Delay in Treatment. Howard A. Kelly, M. D., The Therapeutic Gazette, May 15, 1922, p. 308.

TWO pictures of very advanced cases of epithelioma, which have destroyed almost the entire face are shown in the original article. The writer states that these photographs have been very useful in persuading patients with beginning cancer of the face to take the necessary treatment before too late.

In happy contrast to these pictures are four others of patients cured by radium—and the writer insists that "cured" is the proper terminology, and he speaks from large and long experience.

It has been estimated that nine-five per cent of these growths can be eliminated by radium with proper dosage and technique. It is important that the first treatment "knock out" the disease and that the sound tissues underneath be not injured. The use of radium is an art and too many attempt its use without sufficient skill. The capable radiotherapist can attain success even in some of the most advanced of these cases. Large growths must never be treated with small quantities (twenty, thirty, or fifty milligrammes) of radium.